



PowerPath for UNIX
Version 4.0

**INSTALLATION AND
ADMINISTRATION GUIDE**

**P/N 300-000-978
REV A03**

EMC Corporation

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Printed July, 2003

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As part of its effort to continuously improve and enhance the performance and capabilities of the EMC product line, EMC periodically releases new versions of the PowerPath software. Therefore, some functions described in this manual may not be supported by all versions of the PowerPath products or the storage-system hardware they support. For the most up-to-date information on product features, see the PowerPath release notes.

If a feature does not function properly or as described in this manual, please contact the EMC Customer Support Center for assistance. Refer to Where to Get Help on page xiii for contact information.

This guide describes the features and functionality of EMC PowerPath Version 4.0.

Audience and Prerequisites

This manual is part of the PowerPath documentation set. It is intended for use by storage administrators and other information system professionals responsible for using, installing, and maintaining PowerPath.

Readers of this manual are expected to be familiar with the Solaris operating system, storage-system management, and the applications used with PowerPath.

Organization

Here is an overview of the information contained in this guide:

- ◆ Chapter 1, *Installing PowerPath*, describes how to install PowerPath on a Solaris host, how to upgrade from an earlier version of PowerPath, and how to install the PowerPath Volume Manager VCS Agent.
- ◆ Chapter 2, *PowerPath in a Cluster Environment*, describes how to install and configure PowerPath in Sun Cluster, Legato AAM, and VERITAS Cluster Server environments.
- ◆ Chapter 3, *Configuring a PowerPath Boot Device on Solaris*, describes how to configure a PowerPath device as the boot device.
- ◆ Chapter 4, *Removing PowerPath*, describes how to remove PowerPath from a Solaris host.
- ◆ Chapter 5, *PowerPath Administration on Solaris*, discusses Solaris issues and administrative tasks.
- ◆ Appendix A, *Files Changed By PowerPath*, lists files that are created or modified by PowerPath installation and upgrade.
- ◆ Appendix B, *Customer Support*, reviews the EMC process for detecting and resolving software problems, and provides essential questions you should answer before contacting the EMC Customer Support Center.

Related Documentation

Here is the complete set of PowerPath documentation; all manuals are available from EMC Corporation:

- ◆ *PowerPath Product Guide*, EMC P/N 300-000-979
- ◆ *PowerPath for UNIX Volume Manager User's Guide*, EMC P/N 300-000-992
- ◆ *PowerPath for UNIX Installation and Administration Guide*, EMC P/N 300-000-978
- ◆ *PowerPath for UNIX Quick Reference*, EMC P/N 300-000-981
- ◆ *PowerPath for UNIX Volume Manager Quick Reference*, EMC P/N 300-000-982
- ◆ *Installing and Configuring Emcpower Devices With Solaris Applications*, P/N 300-000-786 (electronic version only)
- ◆ *EMC PowerPath Release Notes*, EMC P/N 300-000-980

These documents are updated periodically. Electronic versions of the updated manuals are available on the Powerlink website:
<http://powerlink.emc.com>.

Symmetrix users should also refer to the *EMC Host Connectivity Guides*, which are available on the Powerlink website.

CLARiiON users should also refer to the following manuals:

- ◆ *EMC Host Connectivity Guides*
- ◆ *EMC Installation Roadmap for CX-Series and FC-Series Storage Systems*, EMC P/N 069001166
- ◆ *EMC ControlCenter Navisphere Manager Version 6.X Administrator's Guide*, EMC P/N 069001125

Another related EMC enterprise storage publication is the EMC Support Matrix, available on the Web. Go to this page:

<http://www.emc.com/horizontal/interoperability>

Choose the link to EMC Interoperability Support Matrices, and then the link to EMC Support Matrix.

Conventions Used in This Guide

EMC uses the following conventions for notes, cautions, warnings, and danger notices.

A note presents information that is important, but not hazard-related.



CAUTION

A caution contains information essential to avoid damage to the system or equipment. The caution may apply to hardware or software.

Typographical Conventions

EMC uses the following type style conventions in this guide:

AVANT GARDE	Keystrokes
Palatino, bold	<ul style="list-style-type: none"> ◆ Dialog box, button, icon, and menu items in text ◆ Selections you can make from the user interface, including buttons, icons, options, and field names
<i>Palatino, italic</i>	<ul style="list-style-type: none"> ◆ New terms or unique word usage in text ◆ Command line arguments when used in text ◆ Book titles
<i>Courier, italic</i>	Arguments used in examples of command line syntax.
Courier	System prompts and displays and specific filenames or complete paths. For example: working root directory [/user/emc]: c:\Program Files\EMC\Symapi\db
Courier, bold	<ul style="list-style-type: none"> ◆ User entry. For example: symmpoll -p ◆ Options in command line syntax

Where to Get Help

For questions about technical support, call your local sales office or service provider.

If you have a valid EMC service contract, contact EMC Customer Service at:

United States: (800) 782-4362 (SVC-4EMC)

Canada: (800) 543-4782 (543-4SVC)

Worldwide: (508) 497-7901

Follow the voice menu prompts to open a service call and select the applicable product support.

Sales and Customer Service Contacts

For the list of EMC sales locations, please access the EMC home page at:

<http://www.emc.com/contact/>

For additional information on the EMC products and services available to customers and partners, refer to the EMC Powerlink website at:

<http://powerlink.emc.com>

EMC Support Matrix

For information about products and technologies qualified for use with the EMC software described in this manual, go to this EMC Web page:

<http://www.emc.com/horizontal/interoperability>

Choose the link to EMC Interoperability Support Matrices, and then the link to EMC Support Matrix.

Your Comments

Your suggestions will help us continue to improve the accuracy, organization, and overall quality of the user publications. Please send a message to **techpub_comments@EMC.com** with your opinions of this guide.

Installing PowerPath

This chapter describes how to install PowerPath 4.0 on a Solaris host and how to upgrade from an earlier version of PowerPath. The chapter also describes how to install the PowerPath Volume Manager VCS Agent for a VERITAS Cluster Server (VCS) environment.

The PowerPath Volume Manager Legato Agent is not part of the PowerPath 4.0 package. See the appropriate Legato documentation for information on installing and configuring that agent.

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Before You Install

The sequence in which you configure the storage and install PowerPath® depends on the storage system you use:

Symmetrix® storage systems. Install PowerPath *after* you set up the Symmetrix system. Verify that the Symmetrix system is working properly, then install PowerPath using the instructions in this guide.

CLARiiON® storage systems. PowerPath installation is an integral part of a CLARiiON setup and configuration procedure. To properly install PowerPath on a host with a CLARiiON array, refer to the *EMC Installation Roadmap for CX-Series and FC-Series Storage Systems*. There you will find step-by-step instructions for installing PowerPath and other CLARiiON software.

The rest of this section describes what to do before you install PowerPath on the host.

Obtain Up-To-Date Information

Check the Powerlink website (<http://powerlink.emc.com>) for the most current information:

- Release notes — We update the PowerPath release notes periodically and post them on the Web.
- Patches and notices — Review the patch ReadMe files to determine which patches (if any) you want to install after PowerPath, and whether those patches have any added prerequisites that must be met before you install PowerPath.

Choose a Convenient Time

Installing PowerPath requires you to reboot the host. Plan to install or upgrade PowerPath when a reboot will cause minimal disruption to your site.

Locate Your License Key

The PowerPath license registration key is on the License Key Card delivered with the PowerPath media kit.

If you are upgrading from an earlier version of PowerPath, you need not reregister; PowerPath will use your old key.

Prepare the Host and Storage System

To prepare the host and storage system:

- ❑ Verify that your environment meets the requirements in:
 - ❑ *Environment and System Requirements* section of the *EMC PowerPath Release Notes*. That section describes minimum hardware and software requirements for the host and supported storage systems.
 - ❑ Chapter 3, *PowerPath Configuration Requirements*, in the *PowerPath Product Guide*. That chapter describes the host-storage system interconnection topologies that PowerPath supports.
- ❑ Set up the SCSI target and LUN or Fibre Channel port and LUN addresses. Refer to the *EMC Host Connectivity Guides* or *Installation Roadmap for FC-Series Storage Systems*.

In the `/etc/system` file, make sure the timeout value is set to 60 seconds. This minimizes path failover time without compromising online storage-system microcode or base code upgrades. The entry must be a hexadecimal number:

```
set sd: sd_io_time = 0x3C
```

- ❑ Use the Solaris `format` utility to format, partition, and label the unused storage system devices such that each unused device has a partition 2 that occupies the entire device. Do not, however, use or mount these devices before installing PowerPath.

- ❑ Uninstall any earlier version of PowerPath.

The PowerPath installation program exits if it detects an existing version of PowerPath.

Important: Before you uninstall the earlier version, save your configuration using the `powermt save` command. Refer to the documentation for the earlier version for further uninstallation instructions.

You need not reboot the host after you uninstall the earlier version of PowerPath. You must, however, reboot the host after you install PowerPath 4.0.

- ❑ Configure HBA drivers.

CAUTION

Be sure to follow HBA driver configuration guidelines outlined by EMC in the EMC Support Matrix and product documentation.

Using improper settings can cause erratic failover behavior, such as greatly increased I/O delays.

- ❑ For hosts connected to storage arrays via a Fibre Channel switch (that is, a fabric), configure the HBAs using persistent binding for SCSI target IDs.

CAUTION

Failure to do so could result in loss or corruption of data.

For information about persistent binding, refer to the *Host Connectivity Guide for Sun Solaris*, the HBA driver documentation, and the `.conf` file for your HBA type.

- ❑ Optionally, configure the host to send warnings to the console.

By default, warning messages are sent only to the log file. To see warnings on the console:

1. Add the following line to the `/etc/syslog.conf` file:

```
localX.Warn /dev/sysmsg
```

where `X` is a value that is not used by any other `local` setting in `/etc/syslog.conf`.

For example:

```
local0.Warn /dev/sysmsg
```

The separator between `localX.Warn` and `/dev/sysmsg` must be a tab character.

2. Set the `RAD_LOG_FACILITY` environment variable to `LOG_LOCALX`, where `X` is the number you used in the `local` setting of the `/etc/syslog.conf` file.

For example, for `csch`, enter:

```
setenv RAD_LOG_FACILITY LOG_LOCAL0
```

For `sh`, enter:

```
RAD_LOG_FACILITY=LOG_LOCAL0; export RAD_LOG_FACILITY
```

Prepare For a Clustered Environment

If you are installing PowerPath in a clustered environment:

- Prepare the cluster environment.

Refer to Chapter 2, *PowerPath in a Cluster Environment*, for information on installing PowerPath in a new or existing cluster.

- Find a major number that can be assigned to the PowerPath driver, `emcp`, on every host in the cluster. This must be a unique number that is unused by any host in the cluster. The installation will prompt you for this number.

Setting the major number is necessary only if you intend to use NFS mounted file systems on PowerPath Volume Manager volumes in your cluster. For more information, refer to *Setting Major and Minor Numbers* on page 2-13.

To find a unique major number:

1. Enter the following command on every host in the cluster:

```
sort -n +1 /etc/name_to_major
```

2. Note the highest major number on every node.

Then, when the installation prompts for a major number, use a number that is higher than all of these.

Installing PowerPath 4.0

This section describes how to install, or reinstall, PowerPath 4.0 when no earlier version of PowerPath has been installed on the host.

If you are upgrading to PowerPath 4.0 from PowerPath 3.0.x or 2.1, refer instead to *Upgrading to PowerPath 4.0* on page 1-10.

Mount the CD-ROM

1. Log in as root.
2. Insert the CD-ROM into the CD-ROM drive.

If the CD mounts automatically, continue with *Install the Software*, which follows.

If the CD does not mount automatically, you must mount it manually. Continue with step 3.

3. Mount the CD on your file system. For example, to mount the CD on `/cdrom/cdrom0`, enter:

```
mount -F hsfs -r /dev/dsk/cxytdzs0 /cdrom/cdrom0
```

where *x*, *y*, and *z* are values specific to the host's CD-ROM drive. For example:

```
mount -F hsfs -r /dev/dsk/c0t2d0s0 /cdrom/cdrom0
```

Install the Software

1. If you do not have a graphics terminal, run the `script filename` command to record `pkgadd` output in the specified file. (After `pkgadd` completes, use CTRL-D to stop recording the output.)
2. Change to the `/mount_point/UNIX/SOLARIS` directory. For example, enter:

```
cd /cdrom/cdrom0/UNIX/SOLARIS
```

3. Start the installation program. Enter:

```
/usr/sbin/pkgadd -d .
```

4. You see the following prompt:

The following packages are available:

```
1 EMCpower  EMC PowerPath
              (all) 4.0.0_bxxx
2 EMCvg     EMC Enterprise Cluster PowerPath Volume
              Manager VCS Agent
              (sparc) 1.0
```

Select package(s) you wish to process (or 'all' to process all packages). (default: all) [?,??,q]:

Enter **1** and press ENTER.

5. You are prompted for the directory where the PowerPath program files will be installed:

Enter package base directory (default: /opt,?):

Press ENTER to accept the default base directory (/opt), or type the path to an alternate base directory and press ENTER.

PowerPath installs its files in */basedir/EMCpower*; the installation process creates the *EMCpower* subdirectory. Make a note of the name and location of the PowerPath base directory for future reference.

6. You are prompted for the directory where the log files will reside:

Enter directory for logging (default: */basedir/EMCpower/log*):

Press ENTER to accept the default (*/basedir/EMCpower/log*), or type the path to an alternate log files directory and press ENTER. You must specify a local file system.

7. You see the following prompt:

Install for cluster environment [y,n,q,?] (default: n):

- If you are installing PowerPath on a standalone system, press ENTER. Go to step 10.
- If you are installing PowerPath in a clustered environment, enter **y** and press ENTER. Continue with step 8.

8. You are prompted for a major number that can be assigned to the PowerPath device driver (`emcp`) on every host in the cluster:

Assign major number for the device driver [?]:

Enter a major number and press ENTER. You must specify a major number that is not used by any host in the cluster.

The installation will assign this major number to the PowerPath driver. Specify this major number during PowerPath installation on every other host in the cluster.

9. You are prompted to confirm the major number:

Major *major* will be assigned to the device driver [y,n,q,?] (default: y):

Press ENTER to confirm the major number.

If you have already installed PowerPath 4.0 on the host and are now *reinstalling* the PowerPath 4.0 software, you see the following prompt:

Configuration for PowerPath 4.0 exists - want to upgrade [y,n,q,?] (default: y):

Press ENTER to preserve your PowerPath configuration.

Enter **n** and press ENTER to overwrite your PowerPath configuration.

10. You see the following prompt:

This package contains scripts which will be executed with super-user permission during the process of installing this package.

Do you want to continue with the installation of <EMCpower> [y,n,?]

Enter **y** and press ENTER.

11. The screen displays information about the installation, ending with:

```
-----  
* EMCpower installation:  
*  
* Installation is successful.  
*  
* If you have a license key card, register now. Then  
* REBOOT the host to complete the remaining steps of the  
* installation. Refer to the PowerPath for UNIX  
* Installation and Administration Guide for more  
* information.  
-----
```

Installation of <EMCpower> was successful.

The following packages are available:

```
1  EMCpower  EMC PowerPath  
          (all) 4.0.0_bxxx  
2  EMCvg     EMC Enterprise Cluster PowerPath Volume  
          Manager VCS Agent  
          (sparc) 1.0
```

Select package(s) you wish to process (or 'all' to process all packages). (default: all) [?,??,q]:

- If you are installing PowerPath for a VCS cluster and you want to install the PowerPath Volume Manager VCS Agent now, enter **2** and press ENTER. Continue with *Install the VCS Agent Software*, step 5, on page 1-22.
- Otherwise, enter **q** and press ENTER.

PowerPath is now installed on the host. You must register PowerPath, reboot the host, and perform other administrative tasks before PowerPath can run on the host. Refer to *After You Install* on page 1-16 for postinstallation information and procedures.

Upgrading to PowerPath 4.0

This section describes how to upgrade to PowerPath 4.0 from an earlier version of PowerPath.

About Upgrading

You can upgrade to PowerPath 4.0 from the following releases:

- ◆ PowerPath 3.0.x
- ◆ PowerPath 2.1

To upgrade from PowerPath 1.5 or 2.0, you must first upgrade to PowerPath 2.1 or 3.0.x and then upgrade to PowerPath 4.0.

After upgrading from PowerPath 2.0 to PowerPath 2.1 or 3.0.x, you must restore your configuration by running the following command:
`powermt load file=/etc/powermt.custom.pre-pp2.1.0`. Then upgrade to PowerPath 4.0.

Uninstalling the Earlier Version

Before upgrading to PowerPath 4.0, you must uninstall the earlier version of PowerPath. Follow the instructions in the documentation for that version. *Note, however, that you need not reboot the host after you uninstall the earlier version.*

Upgrading from PowerPath 2.1: Before you uninstall PowerPath 2.1, search the file `/etc/profile` for the following string: `end of additions`. If you find that string, replace it with the following string: `done additions`.

Licenses

The upgrade preserves your existing PowerPath license. You need not reenter license information.

Configuration Files

With the release of PowerPath 4.0, PowerPath configuration files have changed in both content and number. The upgrade converts your PowerPath 3.0.x or 2.1 configuration files to the newer formats.

The old configuration files are saved in `/etc/emc/emcpxarchive`.

Upgrading From PowerPath 3.0.x or 2.1

Mount the CD-ROM

1. Log in as root.

2. Insert the CD-ROM into the CD-ROM drive.

If the CD mounts automatically, continue with *Install the Software*, which follows.

If the CD does not mount automatically, you must mount it manually. Continue with step 3.

3. Mount the CD on your file system. For example, to mount the CD on `/cdrom/cdrom0`, enter:

```
mount -F hsfs -r /dev/dsk/cxytzyz0 /cdrom/cdrom0
```

where *x*, *y*, and *z* are values specific to the host's CD-ROM drive. For example:

```
mount -F hsfs -r /dev/dsk/c0t2d0s0 /cdrom/cdrom0
```

Install the Software

1. If you do not have a graphics terminal, run the `script filename` command to record `pkgadd` output in the specified file. (After `pkgadd` completes, use CTRL-D to stop recording the output.)

2. Change to the `/mount_point/UNIX/SOLARIS` directory. For example, enter:

```
cd /cdrom/cdrom0/UNIX/SOLARIS
```

3. Start the installation program. Enter:

```
/usr/sbin/pkgadd -d .
```

4. You see the following prompt:

```
The following packages are available:
```

- ```
1 EMCpower EMC PowerPath
 (all) 4.0.0_bxxx
2 EMCvg EMC Enterprise Cluster PowerPath Volume
 Manager VCS Agent
 (sparc) 1.0
```

```
Select package(s) you wish to process (or 'all' to
process all packages). (default: all) [?,??,q]:
```

Enter **1** and press ENTER.

5. You are prompted for the directory where the PowerPath program files will be installed:

Enter package base directory (default: /opt,?):

Press ENTER to accept the default base directory (/opt), or type the path to an alternate base directory and press ENTER.

---

PowerPath installs its files in */basedir/EMCpower*; the installation process creates the *EMCpower* subdirectory. Make a note of the name and location of the PowerPath base directory for future reference.

---

6. You are prompted for the directory where the log files will reside:

Enter directory for logging (default: */basedir/EMCpower/log*):

Press ENTER to accept the default (*/basedir/EMCpower/log*), or type the path to an alternate log files directory and press ENTER. You must specify a local file system.

7. You see the following prompt:

Install for cluster environment [y,n,q,?] (default: n):

- If you are installing PowerPath on a standalone system, press ENTER. Go to step 10.
- If you are installing PowerPath in a clustered environment, enter **y** and press ENTER. Continue with step 8.

8. You are prompted for a major number that can be assigned to the PowerPath device driver (*emcp*) on every host in the cluster:

Assign major number for the device driver [?]:

Enter a major number and press ENTER. You must specify a major number that is not used by any host in the cluster.

---

The installation will assign this major number to the PowerPath driver. Specify this major number during PowerPath installation on every other host in the cluster.

---

9. You are prompted to confirm the major number:

Major *major* will be assigned to the device driver [y,n,q,?] (default: y):

Press ENTER to confirm the major number.

10. You see the following prompt:

Configuration for PowerPath *version* exists - want to  
upgrade [y,n,q,?] (default: y):

where *version* is either 3.0.x or 2.x.

Press ENTER to upgrade.

11. You see the following prompt:

This package contains scripts which will be executed  
with super-user permission during the process of  
installing this package.

Do you want to continue with the installation of  
<EMCpower> [y,n,?]

Enter **y** and press ENTER.

12. The screen displays information about the installation. Provided the upgrade is successful (that is, conversion of the configuration files succeeds) the display ends with:

```

* EMCpower installation:
*
* Installation is successful.
*
* Please REBOOT the host to complete the remaining steps of the installation.
* Refer to the PowerPath for UNIX Installation and Administration Guide for more
* information.

```

The following packages are available:

```
1 EMCpower EMC PowerPath
 (all) 4.0.0_bxxx
2 EMCvg EMC Enterprise Cluster PowerPath Volume
 Manager VCS Agent
 (sparc) 1.0
```

Select package(s) you wish to process (or 'all' to process all packages). (default: all) [?,??,q]:

---

**Important:** If the display indicates that conversion of the configuration files failed, refer to *Troubleshooting the Upgrade* on page 1-15.

---

- If you are installing PowerPath for a VCS cluster and you want to install the PowerPath Volume Manager VCS Agent now, enter **2** and press ENTER. Continue with *Install the VCS Agent Software*, step 5, on page 1-22.
- Otherwise, enter **q** and press ENTER.

PowerPath 4.0 is now installed on the host. You must reboot the host and perform other administrative tasks before PowerPath can run on the host. Refer to *After You Install* on page 1-16 for postinstallation information and procedures.

## Troubleshooting the Upgrade

Upgrading to PowerPath 4.0 could fail for the following reasons:

- ◆ The PowerPath 3.0.x or 2.1 configuration files are corrupted.
- ◆ You inadvertently chose not to upgrade; that is, you answered **n** instead of **y** to the following prompt:

```
Configuration for PowerPath version exists - want to
upgrade [y,n,q,?] (default: y):
```

The following sections describe what to do under these circumstances.

### If files are corrupted

If the PowerPath 3.0.x or 2.1 configuration files are corrupted, your custom configuration is no longer available after you install PowerPath 4.0. If any of your applications are configured with PowerPath pseudo devices, you must reconfigure those applications. Refer to *Installing and Configuring Emcpower Devices With Solaris Applications*, which is available on the Powerlink website (<http://powerlink.emc.com>).

### If you chose not to upgrade

If you inadvertently answer no to the upgrade prompt, before you reboot the host:

1. Run the `emcpupgrade check` command to check whether upgrade is possible. Enter:

```
emcpupgrade check -f /etc/emc/emcpxarchive/powermt.custom.saved
```

If the check fails, the upgrade cannot take place. Contact EMC Customer Support.

If the check succeeds, continue with step 2.

2. Run the `emcpupgrade convert` command to convert the PowerPath 3.0.x or 2.1 configuration files to the PowerPath 4.0 format. Enter:

```
emcpupgrade convert -f /etc/emc/emcpxarchive/powermt.custom.saved
```

3. Run the `emcpupgrade validate` command to verify that the conversion succeeded. Enter:

```
emcpupgrade validate
```

For information about the `emcpupgrade` utility, refer to Chapter 5 of the *PowerPath Product Guide*.

## After You Install

After installing the PowerPath software:

- Register PowerPath on the host (first-time installation only).
- Remove the CD-ROM.
- Reboot the host.
- Verify the PowerPath installation.
- Verify the PowerPath commands are in your path.
- Verify that PowerPath devices are configured on the host.
- Optionally, reconfigure applications to use emcpower devices.

The following sections describe these procedures.

### Register PowerPath on the Host

If you have previously registered an earlier version of PowerPath on the host, PowerPath will use your old key; you need not reregister. (Note, however, that if your previous registration was for evaluation purposes, and the registration has expired, you must reregister before you reboot the host).

To register the PowerPath software:

1. Enter:

```
/etc/emcpreg -install
```

You see the following output:

```
===== EMC PowerPath Registration =====
Do you have a new registration key or keys to enter? [n]
```

2. Type **y** and press ENTER.

You see the following output:

```
Enter the registration key(s) for your product(s),
one per line, pressing Enter after each key.
After typing all keys, press Enter again.
```

```
Key (Enter if done):
```

3. Enter the PowerPath registration key and press ENTER.

If you entered a valid key, you see the following output:

```
1 key(s) successfully added.
Key successfully installed.
```

```
Key (Enter if done):
```

4. Press ENTER. You see the following output:

```
1 key(s) successfully registered.
```

Registering PowerPath after you install the software and before you reboot the host sets the appropriate default load balancing and failover policy. If you reboot the host before you register PowerPath, you must run the `powermt set policy` to reset the load balancing and failover policy. Refer to the *PowerPath Product Guide* or the `powermt(1)` man page for more information on `powermt set policy`.

---

## Remove the CD-ROM

1. If the CD-ROM volume management daemon `vold` is running, unmount and eject the CD-ROM. Enter:

```
eject
```

and remove it from the drive.

2. If `vold` is not running, unmount the CD-ROM. For example, enter:

```
umount /cdrom/cdrom0
```

and, after the CD-ROM unmounts, eject it and remove it from the drive.

---

## Reboot the Host

Reboot the host. Enter:

```
reboot -- -r
```

Registering PowerPath after you install the software and before you reboot the host sets the appropriate default load balancing and failover policy. (Refer to *Register PowerPath on the Host* on page 1-16.) If you reboot the host before you register PowerPath, you must run the `powermt set policy` to reset the load balancing and failover policy. Refer to the *PowerPath Product Guide* or the `powermt(1)` man page for more information on `powermt set policy`.

## Verify the PowerPath Installation

1. Verify that PowerPath is installed properly on the host. Enter:

```
pkginfo -l EMCpower
```

You should see output like the following:

```
PKGINST: EMCpower
NAME: EMC PowerPath
CATEGORY: system
ARCH: sparc
VERSION: 4.0.0_bxxx
BASEDIR: /opt
VENDOR: EMC
PSTAMP: cambridge951018123443
INSDATE: Mar 14 2003 08:36
STATUS: completely installed
FILES: 292 installed pathnames
 5 shared pathnames
 17 directories
 139 executables
 137622 blocks used (approx)
```

2. If you installed the PowerPath Volume Manager VCS Agent, verify that the agent is installed properly on the host. Enter:

```
pkginfo -l EMCvlg
```

You should see output similar to this:

```
PKGINST: EMCvlg
NAME: EMC Enterprise Cluster PowerPath Volume Manager VCS Agent
CATEGORY: system
ARCH: sparc
VERSION: 1.0
VENDOR: EMC Corporation
DESC: EMC Enterprise Cluster PowerPath Volume Manager VCS Agent
PSTAMP: 1.0 EMC: 1.0.0.xxx
INSDATE: Nov 20 2002 15:31
EMAIL: support@emc.com
STATUS: completely installed
FILES: 29 installed pathnames
 8 shared pathnames
 14 directories
 10 executables
 273 blocks used (approx)
```



- Verify that the PowerPath and PowerPath Volume Manager kernel extensions are loaded on the host. Enter:

```
modinfo | grep -i emc
```

You should see output like the following:

```
30 125c08b 74a05 255 1 emcp (PP Driver 4.0.0)
31 127ec94 18c1e - 1 emcpmp (PP MP Ext 4.0.0)
32 1295a42 21ac2 - 1 emcpmpc (PP MPC Ext 4.0.0)
33 12b4f4c c905c - 1 emcpsapi (PP SAPI Ext 4.0.0)
34 134f510 11e1d - 1 emcpcg (PP CG Ext 4.0.0)
35 13608a5 2410 - 1 emcphr (PP HR Ext 4.0.0)
36 136276d 46bc6 - 1 emcpsm (PV SM Ext 4.0.0)
39 13a4aa9 5b8b4 - 1 emcpsc (PV SC Ext 4.0.0)
40 7816a000 5461f - 1 emcpevm (PV EVM Ext 4.0.0)
41 13e957d 22acd - 1 emcpdpm (PV DPM Ext 4.0.0)
42 7811b2e6 273 - 1 emcpioc (PP PIOC 4.0.0)
```

### Verify the PowerPath Commands Are in Your Path

Check that the PowerPath commands are in your path. PowerPath installation modifies the `/etc/profile` and `/etc/.login` files to run the PowerPath setup scripts, which modify the `PATH`, `LD_LIBRARY_PATH`, `LD_LIBRARY_PATH_64`, and `MANPATH` variables on the host.

If you find that the PowerPath commands are not in your path, check the `.profile`, `.login`, and `.cshrc` scripts to see if they are overwriting the changes made by the PowerPath setup scripts.

### Verify PowerPath Devices Are Configured on the Host

To verify that PowerPath devices are configured on the host:

- Enter:

```
powermt display dev=all
```

You should see output like the following:

```
Pseudo name=emcpower0a
Symmetrix ID=000000003269;
Logical device ID=048
state=alive; policy=SymmOpt; priority=0; queued-I/Os=0
=====
----- Hosts ----- - Sys - - I/O Paths - --- Stats ----
HW Path I/O Path Interf. Mode State Q-I/Os Errors
=====
2300 sbus@f/QLGC,isp@2 c2t1d0 SA 16aB active alive 0 0
2301 sbus@f/QLGC,isp@2 c1t1d0 SA 16aA active alive 0 0
2302 sbus@f/QLGC,isp@2 c3t1d0 SA 16bB active alive 0 0
```

2. If the output of `powermt display dev=all` indicates that some storage system logical devices are not configured as PowerPath devices:
  - a. Configure any missing logical devices. Enter:

```
powercf -q
powermt config
```
  - b. Rerun `powermt display dev=all` to confirm that
    - These logical devices are configured as emcpower devices.
    - The correct failover and load balancing policy is set. (For information about `powermt` and load-balancing policies, see the *PowerPath Product Guide*.)

---

If you plan to enable R1/R2 boot disk failover, see *R1/R2 Boot Failover Support* on page 5-4.
  - c. If the failover and load balancing policy is not set correctly, run the command `powermt set policy`, setting the policy that applies to your storage systems.

---

## Reconfigure Applications to Use emcpower Devices

If you plan to use native names (recommended) with a volume manager, file system application, or database manager, you can ignore this section. PowerPath load balancing and failover functionality are enabled with no further action on your part.

However, if you plan to use emcpower devices with a third-party volume manager, file system application, or database manager, you must reconfigure the application to use emcpower devices. Refer to *Installing and Configuring Emcpower Devices With Solaris Applications*, which is available on the Powerlink website (<http://powerlink.emc.com>).

For more information on native and pseudo names, refer to *Device Naming* on page 5-5. If you are unsure whether to use emcpower or native names, contact the EMC Customer Support Center.

## Installing the PowerPath Volume Manager VCS Agent

You can install the VCS Agent at the time you install PowerPath, or you can install the agent separately. This section describes how to install the agent separately.

### Mount the CD-ROM

1. Log in as root.
2. Insert the CD-ROM into the CD-ROM drive.

If the CD mounts automatically, continue with *Install the Software*, which follows.

If the CD does not mount automatically, you must mount it manually. Continue with step 3.

3. Mount the CD on your file system. For example, to mount the CD on `/cdrom/cdrom0`, enter:

```
mount -F hsfs -r /dev/dsk/cxydzs0 /cdrom/cdrom0
```

where *x*, *y*, and *z* are values specific to the host's CD-ROM drive. For example:

```
mount -F hsfs -r /dev/dsk/c0t2d0s0 /cdrom/cdrom0
```

### Install the VCS Agent Software

1. If you do not have a graphics terminal, run the `script filename` command to record `pkgadd` output in the specified file. (After `pkgadd` completes, use CTRL-D to stop recording the output.)
2. Change to the `/mount_point/UNIX/SOLARIS` directory. For example, enter:

```
cd /cdrom/cdrom0/UNIX/SOLARIS
```

3. Start the installation program. Enter:

```
/usr/sbin/pkgadd -d .
```

4. You see the following prompt:

The following packages are available:

```
1 EMCpower EMC PowerPath
 (all) 4.0.0_bxxx
2 EMCvg EMC Enterprise Cluster PowerPath Volume
 Manager VCS Agent
 (sparc) 1.0
```

Select package(s) you wish to process (or 'all' to process all packages). (default: all) [?,??,q]:

Enter **2** and press ENTER.

5. The installation program displays the following prompt if it detects files on the host that conflict with files it will install:

```
Do you want to install these conflicting files [y, n, ?, q]
```

Enter **y** and press ENTER.

6. The screen displays information about the installation, ending with the following prompt:

```
Installation of <EMCvg> was successful.
```

The following packages are available:

```
1 EMCpower EMC PowerPath
 (all) 4.0.0_bxxx
2 EMCvg EMC Enterprise Cluster PowerPath Volume
 Manager VCS Agent
 (sparc) 1.0
```

Select package(s) you wish to process (or 'all' to process all packages). (default: all) [?,??,q]:

7. Enter **q** and press ENTER.

The PowerPath Volume Manager VCS Agent is now installed on the host.

To verify that the agent is installed properly on the host, enter:

```
pkginfo -l EMCvg
```

You should output similar to this:

```
PKGINST: EMCvg
NAME: EMC Enterprise Cluster PowerPath Volume Manager VCS Agent
CATEGORY: system
ARCH: sparc
VERSION: 1.0
VENDOR: EMC Corporation
DESC: EMC Enterprise Cluster PowerPath Volume Manager VCS Agent
PSTAMP: 1.0 EMC: 1.0.0.xxx
INSDATE: Nov 20 2002 15:31
EMAIL: support@emc.com
STATUS: completely installed
FILES: 29 installed pathnames
 8 shared pathnames
 14 directories
 10 executables
 273 blocks used (approx)
```

Refer to *Configuring VCS to Recognize PowerPath Volume Manager Resources* on page 2-11, for information on configuring the agent.

---

## Error Messages

Error, warning, and informational messages returned by the PowerPath installation process are described in the *PowerPath Product Guide*, Chapter 6, *PowerPath Messages*.



## PowerPath in a Cluster Environment

This chapter describes how to install and configure PowerPath in Solaris cluster environments. For more general information on clustering, refer to the *Symmetrix High Availability Environment Product Guide* or the *Installation Roadmap for FC-Series Storage Systems*.

PowerPath Volume Manager is currently supported in Legato Automated Availability Manager (AAM) and VERITAS Cluster Server (VCS) clusters only.

- ◆ PowerPath in a Legato 5.1 (or later) AAM Cluster .....2-2
- ◆ PowerPath in a Sun Cluster 2.2.....2-4
- ◆ PowerPath in a Sun Cluster 3.0.....2-6
- ◆ PowerPath in a VERITAS Cluster Server Cluster.....2-8
- ◆ Setting Major and Minor Numbers .....2-13

## PowerPath in a Legato 5.1 (or later) AAM Cluster

This section describes how to:

- ◆ Install PowerPath and Legato Automated Availability Manager (AAM) in a new cluster, that is, where neither the PowerPath nor the AAM software is installed on any host to be included in the cluster.
- ◆ Integrate PowerPath into an existing AAM cluster.

---

### Installing PowerPath in a New AAM Cluster

To install and configure PowerPath and AAM 5.1 (or later) when neither PowerPath nor AAM is installed:

1. Prepare the cluster environment. Refer to the *EMC Host Connectivity Guides* or the *Installation Roadmap for FC-Series Storage Systems* and the relevant AAM documentation.
2. Use the Solaris `format` utility to verify that all storage system devices are seen by each host.
3. Install PowerPath on all nodes. Refer to Chapter 1, *Installing PowerPath*.
4. Install AAM 5.1 (or later) on all nodes. Refer to the relevant AAM documentation.
5. Add PowerPath Volume Manager resources to AAM resource groups. Refer to the relevant AAM documentation.
6. If the AAM agent is not already started, start the agent on each node in the cluster, using either the `ft_startup` command or the Management Console.
7. Verify that the resource group is up and running, and use either the `ftcli` command `ListResourceGroups` or the Management Console to verify that the resource group can fail over to all nodes in the cluster.
8. Set a common minor number for every PowerPath Volume Manager volume in the cluster. Refer to *Setting Major and Minor Numbers* on page 2-13 for information on setting the minor number.



---

## Integrating/ Upgrading PowerPath Into an Existing AAM 5.1 (or later) Cluster

To integrate PowerPath into an existing AAM 5.1 (or later) cluster, follow these steps on each cluster node, one node at a time:

1. Stop cluster services on the node using either the `ft_shutdown` command or the Management Console.
2. Install or upgrade PowerPath on the node. Refer to Chapter 1, *Installing PowerPath*.
3. Start cluster services on the node using either the `ft_startup` command or the Management Console, and wait for the node to be fully reintegrated into the cluster.

## PowerPath in a Sun Cluster 2.2

This section describes how to:

- ◆ Install PowerPath and Sun Cluster 2.2 in a new cluster, that is, where neither the PowerPath nor the Sun Cluster 2.2 software is installed on any host to be included in the cluster.
- ◆ Integrate PowerPath into an existing Sun Cluster 2.2 cluster.

---

### Installing PowerPath in a New Sun Cluster 2.2

To install and configure PowerPath and Sun Cluster 2.2 when neither PowerPath nor Sun Cluster 2.2 is installed:

1. Prepare the cluster environment. Refer to the *EMC Host Connectivity Guides* or the *Installation Roadmap for FC-Series Storage Systems* and the relevant Sun Cluster documentation.

---

Make sure VxVM DMP is disabled. (Refer to *Installing and Configuring emcpower Devices with Solaris Applications*, available on the Powerlink website.)

---

2. Use the Solaris `format` utility to verify that all storage system devices are seen by each host.
3. Install PowerPath on all nodes. Refer to Chapter 1, *Installing PowerPath*.
4. Install Sun Cluster 2.2 on all nodes. Refer to the relevant Sun Cluster documentation.
5. If necessary, configure the quorum device on all nodes.

---

You cannot use a VCMDB device as the quorum device.

---

6. Initialize the root disk group on all nodes.
7. Initialize PowerPath devices on all nodes.
8. Start cluster services on the master node.
9. Designate/create shared disk groups on the master node.
10. Create logical volumes from the designated shared disks.
11. Create a logical host.
12. Start cluster services on the other (non-master) nodes.

---

## Integrating/ Upgrading PowerPath Into an Existing Sun Cluster 2.2

To integrate PowerPath into an existing Sun Cluster 2.2, follow these steps on each cluster node, one node at a time:

1. Stop cluster services on the node using the `scadmin stopnode` command.
2. Make sure VxVM DMP is disabled.
3. Install or upgrade PowerPath on the node. Refer to Chapter 1, *Installing PowerPath*.
4. Start cluster services on the node using the `scadmin startnode` command, and wait for the node to be fully reintegrated into the cluster.

## PowerPath in a Sun Cluster 3.0

This section describes how to:

- ◆ Install PowerPath and Sun Cluster 3.0 in a new cluster, that is, where neither the PowerPath nor the Sun Cluster 3.0 software is installed on any host to be included in the cluster.
- ◆ Integrate PowerPath into an existing Sun Cluster 3.0 cluster.

---

### Installing PowerPath in a New Sun Cluster 3.0

To install and configure PowerPath and Sun Cluster 3.0 when neither PowerPath nor Sun Cluster 3.0 is installed:

1. Prepare the cluster environment. Refer to the *EMC Host Connectivity Guides* or the *Installation Roadmap for FC-Series Storage Systems* and the relevant Sun Cluster documentation.
2. Install PowerPath on all nodes. Refer to Chapter 1, *Installing PowerPath*.
3. Install Sun Cluster 3.0 on all nodes. Refer to the relevant Sun Cluster documentation.
4. Configure the quorum device on all nodes.

---

You cannot use gatekeepers and VCMDB devices as quorum devices.

---

5. Initialize the root disk group on all nodes.
6. Initialize PowerPath devices on all nodes.
7. Start cluster services on the master node.
8. Designate/create shared disk groups on the master node.
9. Create logical volumes from the designated shared disks.
10. Register the disk group.
11. Start cluster services on the other (non-master) nodes.

---

## Integrating/ Upgrading PowerPath Into an Existing Sun Cluster 3.0

To integrate PowerPath into an existing Sun Cluster 3.0, follow these steps on each cluster node, one node at a time.

1. Stop cluster services on the node. Enter:

```
boot -x
```

2. Install or upgrade PowerPath on the node. Refer to Chapter 1, *Installing PowerPath*.
3. Start cluster services on the node. Enter:

```
reboot
```

Wait for the node to be fully reintegrated into the cluster before proceeding to the next node.

## PowerPath in a VERITAS Cluster Server Cluster

This section describes how to:

- ◆ Install PowerPath and VCS in a new cluster, that is, where neither the PowerPath nor the VCS software is installed on any host to be included in the cluster.
- ◆ Integrate PowerPath into an existing VCS cluster.

For new installations of VxVM, use native `c#t#d#` devices. Do not initialize emcpower devices for VxVM using `powervxvm`.

If emcpower devices already exist in a VxVM disk group that is being added as a resource group to VCS, those devices should remain in the disk group as emcpower devices for as long as they comprise active VxVM logical volumes.

---

### Installing PowerPath in a New VCS Cluster

To install PowerPath and VCS when neither PowerPath nor VCS is installed on any host:

1. On each host to be included in the cluster:
  - a. Prepare the cluster hardware, making the necessary networking and disk connections among the hosts and the storage system. Refer to the *EMC Host Connectivity Guides* or the *Installation Roadmap for FC-Series Storage Systems* and the relevant VERITAS Cluster Server documentation for more information.
  - b. Use the Solaris `format` utility to verify that all storage system devices are seen by each host.
  - c. Install PowerPath and, if you are using PowerPath Volume Manager in the cluster, the PowerPath Volume Manager VCS Agent. Refer to Chapter 1, *Installing PowerPath*. Verify that PowerPath can see all the devices.
  - d. Install any applications.
  - e. Install the VCS software, following the installation procedure described in the relevant VERITAS Cluster Server documentation. Initially configure VCS to run without a service group.

If you are using PowerPath Volume Manager in the cluster, proceed with step 2. If you are not using PowerPath Volume Manager, go to step 3.

2. If you are using PowerPath Volume Manager, configure VCS to recognize the PowerPath Volume Manager VCS Agent as a resource type by editing the `/etc/VRTSvcs/conf/config/main.cf` file on one host in the cluster. Refer to *Configuring VCS to Recognize PowerPath Volume Manager Resources* on page 2-11.
3. On each node in the cluster, define the resources (for example, PowerPath Volume Manager volume groups or VxVM volumes) that make up the service group. (You will configure the service group in step 4.)
4. On one host in the cluster (if you are using PowerPath Volume Manager in the cluster, this should be the host where you edited `main.cf` in step 2; otherwise, this can be any host):
  - a. Configure the service group by adding the resources you defined in step 3 to the `/etc/VRTSvcs/conf/config/main.cf` file. The disk or logical device resources should use native `c#t#d#` devices.

---

Using a disk for service group heartbeat instead of a network is subject to restrictions. Not all disks can be used. Consult the VERITAS documentation.

---
  - b. Start cluster services on the host.
  - c. If you are using PowerPath Volume Manager, verify that VCS recognizes the PowerPath Volume Manager VCS Agent as a resource type. Enter:  

```
hatype -list | grep EMC
```

`EMCVg` should be listed in the command output.
5. Start cluster services on each remaining node in the cluster. These hosts rebuild their local configuration files from the `main.cf` file you edited in step 4.a.

6. On each node in the cluster:
  - a. Verify that the service group is up and running, and use either the VCS GUI or the `hagrps` command to verify that the service group can successfully fail over to all hosts in the cluster.
  - b. Set a common minor number for every PowerPath Volume Manager volume in the cluster. Refer to *Setting Major and Minor Numbers* on page 2-13 for information on setting the minor number.
  - c. Add other service groups as needed.

---

### Integrating/ Upgrading PowerPath Into an Existing VCS Cluster

To integrate PowerPath into an existing VCS cluster:

1. On each node in the cluster, stop cluster services on the node using the `hastop -local -evacuate` command.
2. On each node in the cluster, install or upgrade PowerPath on the node, and, if you are using PowerPath Volume Manager, install the PowerPath Volume Manager VCS Agent. Refer to Chapter 1, *Installing PowerPath*.
3. If you are using PowerPath Volume Manager, configure VCS to recognize the PowerPath Volume Manager VCS Agent as a resource type by editing the `/etc/VRTSvcs/conf/config/main.cf` file on one node in the cluster. Refer to *Configuring VCS to Recognize PowerPath Volume Manager Resources* on page 2-11.
4. Use the `hastart` command to start cluster services on the node where you changed the `main.cf` file, and wait for the node to be fully reintegrated into the cluster.
5. Use `hastart` to start the remaining nodes in the cluster, waiting for each node to be fully integrated into the cluster before running `hastart` on the next node.



## Configuring VCS to Recognize PowerPath Volume Manager Resources

After the PowerPath Volume Manager VCS Agent has been installed on a host, you must configure VCS to recognize the agent. To do so, edit the VCS configuration file, `main.cf`, to include the `EMCTypes.cf` file.

The `EMCTypes.cf` file, which is installed on the host during installation of the PowerPath Volume Manager VCS Agent, defines the `EMCVg` resource type. The `EMCVg` resource type describes a PowerPath Volume Manager volume group to VCS.

Figure 2-1 shows the definition of the `EMCVg` resource type.

```
type EMCvg (
 static int NumThreads = 1
 static int OnlineRetryLimit = 5
 static int OnlineTimeout = 300
 static str ArgList[] = { VgName, OpenOption, VgRename,
 VgNewName, RemovePath, StorageElements, VolumeNames}
 NameRule = rad_ + "$symdg_name"
 str VgName
 str OpenOption = RW
 str VgRename
 str VgNewName
 str RemovePath
 str StorageElements[]
 str VolumeNames[]
)
```

**Figure 2-1 EMCvg Resource Type Definition**

Refer to the *PowerPath for UNIX Volume Manager User's Guide* for a description of the attributes in the `EMCVg` resource type.

EMC recommends that you leave the `OnlineTimeout` parameter for VERITAS Cluster Server (VCS) at the default value, 300 seconds. If the volume groups configured as `EMCVg` resources contain more than approximately 500 volumes, set `OnlineTimeout` to 600 seconds.

These values are guidelines only. The threshold for increasing the value of the `OnlineTimeout` parameter is highly configuration dependent, influenced primarily by the structure of the volumes. Experiment with different values to determine the optimal settings for your configuration.

### Editing main.cf to Include EMCTypes.cf

Edit the `/etc/VRTSvcs/conf/config/main.cf` file on one node. The changes are propagated to the other nodes in the cluster when you start VCS on those nodes.

---

You do not need to perform this procedure if GeoSpan 2.0 is installed on the host.

---

To edit the `main.cf` file:

1. Verify that the PowerPath Volume Manager VCS Agent is installed on the host. Enter:

```
pkginfo -l EMCvg
```

2. Save the current `/etc/VRTSvcs/conf/config/main.cf` file to a backup location. For example, enter:

```
cp /etc/VRTSvcs/conf/config/main.cf /etc/VRTSvcs/conf/config/main.cf.orig
```

3. Add the following line to the beginning of `/etc/VRTSvcs/conf/config/main.cf`:

```
include "EMCTypes.cf"
```

4. Verify that there are no errors in the edited `main.cf` file. Enter:

```
hacf -verify config
```

If the verification is successful, no output is displayed. Otherwise, note the error and correct it in the `main.cf` file.

## Setting Major and Minor Numbers

With NFS in a cluster environment:

- ◆ The PowerPath driver, `emcp`, must use the same major number on every node in the cluster.
- ◆ Every PowerPath Volume Manager volume in the cluster must use the same minor number on every node in the cluster.

Otherwise, you may need to restart NFS clients when failover or failback occurs.

### Setting a Common Major number

You set a common major number for every host in the cluster during PowerPath installation (refer to Chapter 1, *Installing PowerPath*).

### Setting a Common Minor Number

Minor numbers are assigned as follows:

- ◆ When you create a PowerPath Volume Manager volume, a minor number is assigned to that volume on the host where the volume is created.
- ◆ When you then test failover on the nodes in the cluster, a minor number is established for every failover host in the cluster.

After you test failover, and before you start to use the new volume, you must ensure that the volume has the same minor number on every node in the cluster. To do so, use the following procedure:

---

The commands in this procedure work whether the volume is imported or deported. Note, however, that departs must be done without using the `-removePaths` option.

---

1. On each node in the cluster, run the `powervol getminor` command to determine the minor number assigned to the volume on that node. Refer to the `powervol(1)` man page for information on `powervol getminor`.
2. If step 1 reveals inconsistent minor numbers, use the `emcpminor` command to find one minor number that can be used for the volume on every host. Refer to the `emcpminor(1)` man page for information on `emcpminor`.

---

While running `emcpminor`, avoid running any other commands that might claim minor numbers.

---

3. On every node in the cluster (except any node that is already using the minor number), run the `powervol setminor` command to set the minor number you chose in step 2. Refer to the `powervol(1)` man page for information on `powervol setminor`.

---

The `powervol setminor` command fails if the volume is open for I/O. It also fails if the minor number is in use, unless you specify the `-autoselect` option.

---

## Configuring a PowerPath Boot Device on Solaris

This chapter describes how to configure a PowerPath device as the boot device for a Solaris host and how to remove PowerPath control over a storage system boot device.

- ◆ Introduction .....3-2
- ◆ Configuring a PowerPath Native Device as the Boot Device.....3-3
- ◆ Moving the Boot Device to an emcpower Device .....3-8
- ◆ Removing PowerPath Control Over a Boot Device ..... 3-11

---

## Introduction

On some storage systems, you can use either a PowerPath native device or an emcpower device as a boot device—the device that contains the startup image. (Refer to the *EMC Support Matrix* to see whether your storage system supports PowerPath boot devices.)

Once the root is mounted, using a PowerPath device as the boot device provides load balancing and path failover for the boot device. Native devices, however, do not provide boot time boot path failover.

---

The HBA on the emcpower device must support booting in FCODE. Examples are the Sun Fast-Wide-Differential adapter and Ultra-SCSI adapter.

---

The following sections describe how to configure a PowerPath native device as the boot device and then move the boot device to an emcpower device.

## Configuring a PowerPath Native Device as the Boot Device

### Partitioning the Boot Device

Partition the boot device.

1. Use the `format` command to verify that the sizes of the partitions on the storage system device chosen for the Solaris installation are large enough to copy the current OS partitions. Examine the partitions of the host source drive where the current OS resides:
  - a. At the `%>` prompt, enter **format** and press `ENTER`.
  - b. When prompted choose disk 0, press `ENTER`.
  - c. At the `format>` prompt, enter **partition** and press `ENTER`.
  - d. At the `partition>` prompt, enter **print** and press `ENTER`.

*Sample output:*

| Part | Tag        | Flag | Cylinders | Size       |
|------|------------|------|-----------|------------|
| 0    | root       | wm   | 0-335     | 24.69 MB   |
| 1    | swap       | wm   | 336-792   | 1169.59 MB |
| 2    | backup     | um   | 0-5846    | 2.12GB     |
| 3    | unassigned | wm   | 0         | 0          |
| 4    | unassigned | wm   | 0         | 0          |
| 5    | unassigned | wm   | 0         | 0          |
| 6    | usr        | wm   | 739-2305  | 561.40 MB  |
| 7    | home       | wm   | 2306-5846 | 1.28GB     |

2. Select the storage system device on which to install the Solaris operating system as follows:
  - a. At the `partition` prompt, enter **quit** and press `ENTER` to return to the `format` menu.
  - b. At the `format` prompt, enter **disk** and press `ENTER`.

Information similar to the following is displayed:

AVAILABLE SELECTIONS

```
...
1. c0t0d0 <SUN4,2G cyl 3880 alt 2 hd 16 sec 135>
 /pci@1f,4000/scsi@3/sd@0,0
2. c3t0d0 <EMC-SYMMETRIX-5265 cyl 4088 alt 2 hd 15 sec
 64> /pci@1f,4000/QLGC,qla@4/sd@0,0
...
specify disk (enter its number):
```

- c. Enter **2** and press ENTER.
3. Repartition the storage system device (if necessary) to model the partition information from the host source drive in order to match the drive configuration:
  - a. At the `format` prompt, enter **partition** and press ENTER.
  - b. At the `partition` prompt, enter **modify** and press ENTER.
  - c. After the partition in the storage system device has been created, enter **modify** and press ENTER at the `format` prompt.
  - d. Verify that the partition size allocated is greater than or equal to the size you specified.

---

## Creating Filesystems

Create filesystems on the required partitions in the designated storage system boot device.

The following example shows a subset of the filesystems you would create when copying the OS to a Symmetrix device of Target 0 LUN 0 on controller 3:

```
newfs /dev/rdisk/c3t0d0s0
newfs /dev/rdisk/c3t0d0s6
newfs /dev/rdisk/c3t0d0s7
```

To use a different storage system device, change `t0d0` to `tStorage_Device_target_numberLUN_number`. To use a different controller, change `c3` to `ccontroller_number`. You must create both the root partition (slice 0) and the `/usr` partition (slice 6). You should also create other partitions (`/export/home`, `/var`, `/opt`) to mirror the current layout. Use the `newfs` command to create the filesystems.



## Installing a Bootblk

Install a *bootblk* (the information required by the host to boot the operating system) on the root partition of the storage system boot device.

1. Use the `uname -a` command to determine the architecture of the workstation. This determines the directory in `/usr/platform` where the *bootblk* will be found. The following example shows `sun4u` as the architecture, and subdirectory for `/usr/platform`.

*Example:* At the `%>` prompt, enter `uname -a` and press ENTER to display a line similar to the following:

```
SunOS patriot 5.8 Generic_108528-15 sun4u Sparc SUNW,Ultra-60
```

2. At the `%>` prompt, enter a command like the following to install a *bootblk* onto the storage system boot device:

```
/usr/sbin/installboot /usr/platform/sun4u/lib/fs/ufs/bootblk\
/dev/rdisk/ccontroller_numberstorage_system_device_target_numberd0s0
```

For example, enter the following command to install a *bootblk* onto a boot device of Target 0 LUN 0 on controller 3:

```
/usr/sbin/installboot /usr/platform/sun4u/lib/fs/ufs/bootblk /dev/rdisk/c3t0d0s0
```

## Copying Required Files

Use `ufsdump` and `ufsrestore` to copy the required files and directories from the host source drive to the storage system boot device.

1. At the `%>` prompt, enter `mount /dev/dsk/c3t0d0s0 /mnt` and press ENTER to mount the root directory of the storage system device to `/mnt`.
2. Use the `ufsdump` command to create the required directory structure on the new storage system device and copy the files.

In the following example, the current operating system is located on `/dev/dsk/c0t0d0`.

*Example:* At the `%>` prompt, enter the following command and press ENTER:

```
ufsdump 0f - /dev/dsk/c0t0d0s0 | (cd /mnt; ufsrestore rf -)
```

When the above command completes, the storage system device (`c3t0d0s0`) will have the complete image of the root partition.

3. In the `/mnt/etc` directory update the `vfstab` file to indicate the storage system boot device address to be mounted during boot. Modify all partitions that will be located on the storage system boot device.
  - a. At the `%>` prompt, enter `cd /mnt/etc` and press ENTER.
  - b. At the `%>` prompt, enter `vi vfstab` and press ENTER.

*Example* — Before modification:

```
#device device mount FS fsck mount mount
#to mount to fsck point type pass at boot options

/dev/dsk/c0t0d0s1 - - swap - no -
/dev/dsk/c0t0d0s0 /dev/rdisk/c0t0d0s0 / ufs 1 no -
/dev/dsk/c0t0d0s6 /dev/rdisk/c0t0d0s6 /usr ufs 1 no -
swap - /tmp tmpfs - yes -
```

*Example* — After modification:

```
#device device mount FS fsck mount mount
#to mount to fsck point type pass at boot options
#
/dev/dsk/c3t0d0s1 - - swap - no -
/dev/dsk/c3t0d0s0 /dev/rdisk/c3t0d0s0 / ufs 1 no -
/dev/dsk/c3t0d0s6 /dev/rdisk/c3t0d0s6 /usr ufs 1 no -
swap - /tmp tmpfs - yes -
```

To increase system performance, you can leave the swap partition on the internal boot drive by leaving the fourth line (`/dev/dsk/c0t0d0s1 - - swap- no -`) unchanged.

4. At the `%>` prompt, enter `umount /mnt` and press ENTER to unmount the root partition.
5. Repeat steps 1, 2, and 4 for the `/usr` partition. In the current root directory:
  - a. At the `%>` prompt, enter `mount /dev/dsk/c3t0d0s6 /mnt` and press ENTER.
  - b. At the `%>` prompt, enter the following command and press ENTER:
 

```
ufsdump 0f - /dev/dsk/c0t0d0s6 | (cd /mnt; ufsrestore rf -)
```
  - c. At the `%>` prompt, enter `umount /mnt` and press ENTER.
6. Repeat steps 1, 2, and 4 for any other partitions to be mounted from the storage system boot device.

## Modifying OpenBoot

You need modify OpenBoot only if you use Fibre Channel HBAs.

The procedure for modifying OpenBoot depends on your HBAs. Refer to the following documentation:

| If you use  | Refer to                                                                                                                                                                                                                                                                  |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Emulex HBAs | <i>EMC Fibre Channel with Emulex Host Bus Adapters in the Solaris Host Environment</i><br><a href="http://emulex.com/ts/docoem/emc/pdfs/Sol_501a.pdf">http://emulex.com/ts/docoem/emc/pdfs/Sol_501a.pdf</a>                                                               |
| QLogic HBAs | <i>EMC Fibre Channel with QLogic Host Bus Adapters in the Solaris Environment</i><br><a href="http://download.qlogic.com/drivers/5419/QLogic_Solaris.pdf">http://download.qlogic.com/drivers/5419/QLogic_Solaris.pdf</a>                                                  |
| JNI HBAs    | <i>EMC Symmetrix Fibre Channel with JNI Emerald Host Bus Adapters in the Solaris Environment</i><br><a href="http://www.jni.com/Drivers/Files/Solaris/FCE2-6412/emc/JNI_Em_Solaris.pdf">http://www.jni.com/Drivers/Files/Solaris/FCE2-6412/emc/JNI_Em_Solaris.pdf</a>     |
|             | <i>EMC Symmetrix Fibre Channel with JNI Tachyon Host Bus Adapters in the Solaris Environment</i><br><a href="http://www.jni.com/Drivers/Files/Solaris/FC64-1063/emc/JNI_Tach_Solaris.pdf">http://www.jni.com/Drivers/Files/Solaris/FC64-1063/emc/JNI_Tach_Solaris.pdf</a> |
|             | <i>EMC Symmetrix Fibre Channel with JNI Emerald 4 Host Bus Adapters in the Solaris Environment</i><br><a href="http://www.jni.com/Drivers/Files/Solaris/FCX2-6562/emc/JNI_Em4_Solaris.pdf">http://www.jni.com/Drivers/Files/Solaris/FCX2-6562/emc/JNI_Em4_Solaris.pdf</a> |

## Setting Up the Boot Alias

Set up a new alias for your new boot disk. At the OK> prompt:

1. Enter **nvalias** *your\_alias* *your\_device* and press ENTER.

Example:

```
nvalias storagedisk /pci@1f,4000/QLGC,qla@4/sd@0,0
```

2. Enter **nvstore** and press ENTER to store your new boot name.
3. Enter **setenv boot-device storagedisk** and press ENTER to change the boot device to the new alias.
4. Enter **setenv auto-boot? false** and press ENTER.
5. Enter **reset -all**.
6. Enter **boot**.

## Moving the Boot Device to an emcpower Device

To move a boot device from a native device to an emcpower device:

1. Boot from the native device.
2. Install PowerPath. Refer to Chapter 1, *Installing PowerPath*.
3. Locate the native device from which you are booting, and correlate this device to an emcpower device. Enter:

```
/etc/powermt display dev=all
```

The output is similar to the following:

```
Pseudo name=emcpower6a
Symmetrix ID=000000005543
Logical device ID=0001
state=alive; policy=SymmOpt; priority=0; queued-I/Os=0
=====
----- Host ----- - Stor - -- I/O Path - -- Stats ---
HW Path I/O Paths Interf. Mode State Q-I/Os Errors
=====
1281 pci@4/QLGC,qla@1 c6t0d252s0 FA 3aA active alive 0 0
1283 pci@6/QLGC,qla@1 c8t0d252s0 FA 3aA active alive 0 0
```

Scroll through the output until you locate the native device used as the boot device; for example, `c1t6d0s0`. In this example, this native device corresponds to `emcpower6a`.

4. Identify the device node that corresponds to the emcpower device. Enter:

```
ls -l /dev/dsk/emcpower6a
```

The output is similar to the following:

```
lrwxrwxrwx 1 root other 33 May 30 17:42 /dev/dsk/emcpower6a ->
../../devices/pseudo/emcp@6:a,blk
```

Looking at the output, you can see that `/pseudo/emcp@6:a,blk` corresponds to `emcpower6a`. You will use this value in step 6.

5. Make backup copies of the `/etc/system` and `/etc/vfstab` files so that, if necessary, you can restore the host to its pre-PowerPath settings. Enter:

```
cp /etc/system /etc/system.no_EMCPower
cp /etc/vfstab /etc/vfstab.no_EMCPower
```

6. Using a text editor such as `vi`, make the following changes to the `/etc/system` file:

- Add this line above the `forceload: drv/emcp` statement:  
`forceload: drv/sd`
- Add this line below the `forceload: drv/emcp` statement:  
`rootdev: /pseudo/emcp@6:a,blk`

The `/etc/system` file now includes the following lines:

```
forceload: drv/sd
forceload: drv/emcp
rootdev: /pseudo/emcp@6:a,blk
```

7. Using a text editor such as `vi`, edit the `/etc/vfstab` file, replacing each native partition (`c#t#d#s#`) for the boot device with an `emcpower` partition name. In this example, you would replace `c1t6d0s0` with `emcpower6a`. You must change both the `/dev/dsk` and `/dev/rdisk` entries.
8. Restart the host. Enter:

```
reboot
```

## Recovery Procedure

If you cannot boot the host after configuring the PowerPath device as the boot device, you may have made a typing error when editing the `/etc/system` and `/etc/vfstab` files. To recover:

1. Insert the Solaris Operating System CD-ROM into the host's CD-ROM drive.
2. At the `ok` prompt, enter:  

```
boot cdrom -s
```
3. Mount the storage system boot device that is experiencing the problem. For example, enter:  

```
mount /dev/dsk/c1t6d0s0 /a
```
4. Enter:  

```
TERM=sun-cmd
export TERM
```
5. Check the `/etc/system` and `/etc/vfstab` files against the changes you made to these files when you set up multipathing to the storage system boot device. Use a text editor such as `vi` to correct any problems you find.

6. Shut down the host. Enter:  
`shutdown -y -g5 -i0`
7. At the `ok` prompt, enter:  
`eject`
8. Remove the Solaris Operating System CD-ROM from the host's CD-ROM drive.
9. Reboot the host. Enter:  
`boot`

## Removing PowerPath Control Over a Boot Device

If your PowerPath installation uses a storage system device as the boot device, use the following procedure to remove PowerPath 4.0 control over the boot device:

1. Determine whether the boot path from the host to the storage system has changed since the storage system boot device was configured.
  - a. Examine the `/etc/vfstab.no_EMCPower` file to identify the native name for the boot device; for example, `c1t6d0s0`. Enter:

```
cat /etc/vfstab.no_EMCPower
```

- b. Determine the boot path associated with this native device. For example, enter:

```
ls -al /dev/dsk/c1t6d0s0
```

An example of a boot path is  
`/pci@1f,4000/scsi@4/disk@6,0`.

- c. Compare the boot path from step 1.b. with the original boot path. Enter:

```
cat /etc/nvramrc.orig
```

2. If the boot path listed in step 1.b. differs from that in the `nvramrc.orig` file, update the boot path to reflect the value listed in step 1.b. For example, enter:

```
eeeprom nvramrc="devalias storagedisk /pci@1f,4000/scsi@4/disk@6,0"
```

3. Verify that the boot path was changed to the new value. Enter:

```
eeeprom
```

4. Restore the versions of `/etc/system` and `/etc/vfstab` that do not contain references to PowerPath. Enter:

```
cp /etc/system.no_EMCPower /etc/system
cp /etc/vfstab.no_EMCPower /etc/vfstab
```

5. If you did not reboot the host after removing PowerPath, do so now. Enter:

```
reboot -- -r
```

---

**Important:** If you plan to reinstall PowerPath 4.0, or upgrade to a later version of PowerPath, you need not reboot the host at this time.

---

If the host fails to boot, refer to *Recovery Procedure* on page 3-9 for suggested actions.



This chapter describes how to remove PowerPath and the PowerPath Volume Manager VCS Agent from a Solaris host.

- ◆ Before Removing PowerPath ..... 4-2
- ◆ Removing PowerPath..... 4-3
- ◆ Removing the PowerPath Volume Manager VCS Agent..... 4-6

## Before Removing PowerPath

Before you remove PowerPath from the host:

- ❑ Check the Powerlink website (<http://powerlink.emc.com>) for the most current information. We update the PowerPath release notes periodically and post them on the Powerlink website.
- ❑ Stop any application and shut down any database that is using emcpower devices or a PowerPath Volume Manager volume. Unmount any file system mounted on a PowerPath Volume Manager volume.
- ❑ *If you are removing PowerPath from the host entirely* (that is, you are not planning to reinstall PowerPath), remove all PowerPath Volume Manager volumes and volume groups allocated on the host:

Run the `powervadm list` command to determine whether any volumes and volume groups are allocated on the host. If volumes and volume groups are allocated, destroy them. Refer to *Destroying a Volume* and *Destroying a Volume Group* in the *PowerPath for UNIX Volume Manager User's Guide*.

- ❑ If you have a database partition, discontinue use of PowerPath devices as follows:
  1. Stop the database manager.
  2. Unmount PowerPath devices.
  3. Edit the appropriate database configuration files so they no longer refer to emcpower devices.
- ❑ If your PowerPath installation uses a storage system device as the boot device, remove PowerPath control over the boot device. Refer to *Removing PowerPath Control Over a Boot Device* on page 3-11.

## Removing PowerPath

Follow these steps to remove PowerPath from a Solaris host:

1. Log in as root.
2. Start the uninstall program. Enter:

```
/usr/sbin/pkgrm EMCpower
```

The screen displays information like this:

```
The following package is currently installed:
EMCpower EMC PowerPath
 (all) 4.0.0_bxxx
```

```
Do you want to remove this package? [y,n,?,q]
```

3. Enter **y** and press ENTER to remove the package.

The screen displays the following information:

```
Removing installed package instance <EMCpower>
```

```
This package contains scripts which will be executed
with super-user permission during the process of
removing this package.
```

```
Do you want to continue with the removal of this package
[y,n,?,q]
```

4. Enter **y** and press ENTER to continue with deinstallation.

The screen displays information about the removal process, ending with:

```

* EMCpower successfully removed.
*
* REBOOT the host to complete the remaining step of the removal.
*
* This reboot may be deferred if you are about to install a
* newer PowerPath product.
*

Updating system information.
Removal of <EMCpower> was successful.
```

If you are removing PowerPath from the host entirely, proceed with step 5.

Otherwise, proceed with step 6.

5. The removal process saves the following files in `/etc/emc/emcpxarchive`, with the `.400.saved` extension:

- `/kernel/drv/emcp.conf`
- `/etc/powermt.custom`
- `/etc/emcp_registration`
- `/etc/emcp_devicesDB.dat`
- `/etc/emcp_devicesDB.idx`
- `/etc/PPVM_config`
- `/etc/PPVM_config_bak`

If the removal program detects existing files with the `.400.saved` extension on the host, it overwrites these files. It does not overwrite saved files that have a different format, for example, `powermt.custom.saved`.

*If you are removing PowerPath from the host entirely (that is, you are not planning to re-install PowerPath):*

- a. Enter the following command to remove these files:

```
/etc/emcpv_cleanup
```

This command removes the PowerPath license and all supporting files.

`emcpv_cleanup` issues the following warning:

```
Warning: Attempt to remove saved configuration
files for PowerPath version versionNumber. Removing
these files will result in loss of saved
configuration and upgrade features. Proceed with
caution!!
```

```
Do you want to continue [y,n,?] (default: n):
```

- b. Enter **y** and press ENTER.

The uninstall program asks for confirmation:

```
Are you sure [y,n,?] (default: n):
```

- c. Enter **y** and press ENTER.

6. Reboot the host. Enter:

```
reboot -- -r
```

---

**Important:** If you plan to reinstall PowerPath 4.0, or upgrade to a later version of PowerPath, you need not reboot the host at this time.

---

## Removing the PowerPath Volume Manager VCS Agent

### CAUTION

**Do not try to remove the EMCvg package while VCS cluster is up and running.**

Complete the following steps to remove the PowerPath Volume Manager VCS Agent:

1. Log in as root.
2. Close the VCS configuration file. Enter:

```
haconf -dump -makero
```

3. Save the current `/etc/VRTSvcs/conf/config/main.cf` file to a backup location. For example, enter:

```
cp /etc/VRTSvcs/conf/config/main.cf /etc/VRTSvcs/conf/config/main.cf.orig
```

4. Identify all EMCvg resources. Enter:

```
hares -display -type EMCvg
```

5. Delete each EMCvg resource that you identified. Enter:

```
hares -delete resource_name
```

6. Delete the EMCvg resource type. Enter:

```
hatype -delete EMCvg
```

7. Verify the configuration changes. Enter:

```
hacf -verify config
```

If the verification is successful, no output is displayed. Otherwise, note the error and correct it in the `main.cf` file.

8. Remove the PowerPath Volume Manager VCS agent package. Enter:

```
/usr/sbin/pkgrm EMCvg
```

The screen displays information like this:

```
The following package is currently installed:
1 EMCvg EMC Enterprise Cluster PowerPath
 Volume Manager VCS Agent
 (sparc) 1.0
```

```
Do you want to remove this package? [y,n,?,q]
```

9. Enter **y** and press ENTER to remove the package.

The screen displays the following information:

```
Removing installed package instance <EMCvg>
```

```
Do you want to continue with the removal of this package
[y,n,?,q]
```

10. Enter **y** and press ENTER to continue with deinstallation.

The screen displays information about the removal process, ending with:

```
Removal of <EMCvg> was successful.
```





This chapter discusses PowerPath issues and administrative tasks specific to Solaris.

Throughout this chapter, many procedural steps use `powermt` commands. For detailed descriptions of these commands, refer to the *PowerPath Product Guide*.

- ◆ PowerPath and CLARiiON Storage Systems.....5-2
- ◆ Ensuring a Sufficient Stack Size .....5-2
- ◆ Booting a Host With Built-In Fibre Channel Ports .....5-2
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## PowerPath and CLARiiON Storage Systems

PowerPath events or actions that entail LUN trespasses (for example, SP failovers or `powermt restore` commands) can cause the Solaris disk driver to log warning and/or error messages. You can ignore these messages, as PowerPath intercepts them and hides them from the application sending the I/O.

For more information on CLARiiON configuration requirements, refer to the *EMC Installation Roadmap for CX-Series and FC-Series Storage Systems* and the *EMC Host Connectivity Guide for Sun Solaris*, available on the Powerlink website.

The *Host Connectivity Guide* describes how to edit the `/kernel/drv/sd.conf` file to suppress ODS device overlap error messages. Note that this workaround is invalid for Sun Cluster 2.2 configurations.

## Ensuring a Sufficient Stack Size

If you install an application that resets the stack size (for example, VxVM or VxFS) after you install PowerPath, make sure that `lwp_default_stksize` and `rpcmod:svc_run_stksize` are set to at least 0x6000 on a Solaris 7, 8, or 9 system, and at least 0x4000 on a Solaris 2.6 system. Other applications may reset the stack sizes to values insufficient for PowerPath.

## Booting a Host With Built-In Fibre Channel Ports

If you boot a Solaris host with all `socal` host adapters to storage system volumes disconnected or dysfunctional, PowerPath will not configure any `socal` host adapter paths. After physically restoring the

socal connections, run the following commands to restore the paths in PowerPath:

| On hosts running this OS | Run these commands                                              |
|--------------------------|-----------------------------------------------------------------|
| Solaris 7, 8, and 9      | <pre>devfsadm powercf -q powermt config</pre>                   |
| Solaris 2.6              | <pre>drvconfig; disks; devlinks powercf -q powermt config</pre> |

## Rebooting and Custom Settings

On every reboot, all saved custom files (`/etc/powermt.custom.[0-2]`) are incremented by one version. Thus, at any time, the custom configurations from the last three reboots are available.

You can ascertain from the custom file timestamps which version of the custom file contains the last valid settings saved prior to a reboot. To restore a custom configuration, enter the following commands:

```
/etc/powermt load file=/etc/powermt.custom.<desired version>
/etc/powermt save
```

Although you can restore an earlier `powermt.custom` file, it is not currently possible to restore an earlier `emcp_devicesDB` file.

## Boot Device Support

Solaris can boot from either a native device or pseudo device. Only pseudo devices (emcpower devices), however, support booting with failed paths. Refer to Chapter 3, *Configuring a PowerPath Boot Device on Solaris*, for more information.

---

## R1/R2 Boot Failover Support

If a storage system device corresponding to a bootable emcpower device is mirrored via SRDF<sup>®</sup>, it is possible in the event of a server failure at the local storage system to fail over the boot disk to the remote mirror disk and then boot the server on an identical remote host.

Contact EMC Customer Support for assistance when configuring R1/R2 boot disk failover.

---

### R1/R2 Supported Configurations

EMC supports the following specific R1/R2 configurations:

- ◆ Each boot host is connected to only one Symmetrix.
- ◆ The two hosts must have identical hardware.
- ◆ All R1 devices reside on one Symmetrix, *Symmetrix A*, and are visible only to a single host, *Host A*.
- ◆ All R2 devices reside on a separate Symmetrix, *Symmetrix B*, and are visible only to the identical host in reserve, *Host B*.
- ◆ Each R1 device has only one mirror. (Concurrent SRDF is not supported.)
- ◆ Neither host has non-mirrored devices, BCVs, or gatekeepers.
- ◆ SRDF is managed from either of the following two facilities:
  - EMC ControlCenter Management Server
  - Symmetrix Service Processor

---

### R1/R2 Boot Procedure

R1/R2 boot support assumes that the systems are configured to boot from an emcpower device. If you plan to enable R1/R2 boot disk failover, after you install PowerPath, run the `powercf -Z` command while booted on the R1 copy of the boot disk. This will update the `emcp.conf` file so that each entry contains both an R1 and an R2 Symmetrix volume ID for the pseudo (emcpower) device.

When the host on the R2 side boots, it is connected to a different Symmetrix system and set of volume IDs. Therefore, the `emcp.conf` and `powermt.custom` files (which are identical to the R1 files since the boot disk is identical) are modified to create a valid mapping between the `emcpower` device and native path device for both R1 and R2 locations. Having both the R1 and R2 Symmetrix volume IDs in the `emcp.conf` file ensures a valid mapping between the pseudo devices and the underlying native path device. PowerPath will determine which Symmetrix volume IDs are valid (that is, the visible ones) and will act accordingly when either the R1 or the R2 host is booted.

---

## Device Naming

PowerPath for Solaris presents PowerPath-enabled storage system logical devices to the operating system by all their native devices plus a single PowerPath-specific pseudo device. Applications and operating system services can use any of these devices—native or pseudo—to access a PowerPath-enabled storage system logical device.

---

### Native Devices

A *native device* describes a device special file of one of the following forms:

- ◆ Block device—`/dev/dsk/c#t#d#s#`
- ◆ Raw device—`/dev/rdisk/c#t#d#s#`

where:

- ◆ The `c #` is the instance number for the interface card.
- ◆ The `t #` is the target address of the storage system logical device on the bus.
- ◆ The `d #` is the storage system logical device at the target.
- ◆ The `s #` is the slice, ranging from 0 to 7.

---

## Pseudo Devices

A *pseudo device* describes a device special file of one of the following forms:

- ◆ Block device—`/dev/dsk/emcpower#[a-h]`
- ◆ Raw device—`/dev/rdisk/emcpower#[a-h]`

where:

- ◆ # is the disk number.
- ◆ [a-h] is the slice.

Slices in Sys V identifiers are designated s0, s1, s2, and so on. They correspond exactly to emcpower slices designated a, b, c, and so on. Therefore, if device `c0t0d0` corresponds to device `emcpower0`, slice `c0t0d0s2` corresponds to slice `emcpower0c`.

---

## Selecting a Device Naming Convention

After PowerPath is installed, a host has both native devices and emcpower devices enabled and available for use. Both native devices and emcpower devices can be active simultaneously on a host.

Native devices are preferable for most installations. Native devices offer the following advantages:

- ◆ If PowerPath is installed, VxVM automatically scans for and recognizes native devices when it (VxVM) is installed. (Pseudo devices must be referenced manually when initializing disks for use with VxVM.)
- ◆ If both PowerPath and VxVM are installed, VxVM automatically scans for and recognizes native devices when volumes are imported. (With pseudo devices, extra manual steps are required to set up disk groups that can be imported.)
- ◆ VxVM provides unqualified support for native names. (VxVM supports pseudo names with the following qualification: pseudo names cause VxVM 3.2 to generate warnings in some circumstances. This is a recognized VERITAS bug, 85455, and EMC has a documented workaround. For details, see <http://seer.support.veritas.com/docs/242612.htm>.)
- ◆ Existing applications, like volume managers and DBMSs, need not be modified to provide PowerPath multipathing and path failover functionality, because they can directly access PowerPath logical devices through native devices. (With pseudo devices, existing applications need to be modified to use this functionality.)

Pseudo (emcpower) devices offer the following advantages:

- ◆ There is only one pseudo device name for each multipathed logical device. (There are multiple native device names for each multipathed logical device, which is harder to manage.)
- ◆ Pseudo device names are easier to manage because there is a one-to-one relationship between pseudo device names and logical volumes. (Native device names are based on HBA, target, and device assignments as recognized at system startup.)
- ◆ Implementing PowerPath's boot-time, boot-path failover feature requires pseudo devices.
- ◆ Operations of Sun Microsystem's Dynamic Reconfiguration (DR) feature are transparent to applications using pseudo devices. (With native devices, these operations are not transparent: `c#t#l#s#` paths are removed, which can be disruptive to applications using those paths.) Refer to *Dynamic Reconfiguration* on page 5-12 for information on using DR to add and remove HBAs in a PowerPath environment.

Table 5-1 summarizes the functional differences between native devices and emcpower devices in the Solaris environment.

**Table 5-1 Native Devices versus emcpower Devices**

| Function                                                                                                                                                                            | Native Device                                                                                                            | Pseudo Device                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| I/O failover                                                                                                                                                                        | ✓                                                                                                                        | ✓                                                                                                                   |
| I/O load balancing                                                                                                                                                                  | ✓                                                                                                                        | ✓                                                                                                                   |
| Booting: boot-path failover                                                                                                                                                         | No                                                                                                                       | ✓                                                                                                                   |
| Reboot (reconfiguration)                                                                                                                                                            | ✓ (Partial support)<br>If a path is missing, PowerPath does not create a “replacement” <code>c#t#d#</code> device.       | ✓ (Full support)                                                                                                    |
| Support for VxVM sliced disks                                                                                                                                                       | ✓                                                                                                                        | No                                                                                                                  |
| Support for VxVM simple disks                                                                                                                                                       | ✓                                                                                                                        | ✓                                                                                                                   |
| Support for Solaris disk partitions (slices)                                                                                                                                        | ✓                                                                                                                        | ✓                                                                                                                   |
| Support for interaction with VxVM DMP (Dynamic MultiPathing)<br>(When using PowerPath 4.0.0, you can manage a CLARiiON® storage system with either PowerPath or DMP, but not both.) | ✓                                                                                                                        | ✓                                                                                                                   |
| DR transparency                                                                                                                                                                     | Limitations — <code>c#t#d#s#</code> paths are removed, which can be disruptive to applications using those paths.        | ✓                                                                                                                   |
| IOCTL deterministic path selection                                                                                                                                                  | ✓ (PowerPath selects the specific path.)                                                                                 | No (PowerPath selects an arbitrary path.)                                                                           |
| PowerPath's No Redirect load-balancing and failover policy (transparent mode)                                                                                                       | Native devices deliver I/O to the path where it would go if PowerPath were not installed. If that path fails, I/Os fail. | Pseudo devices select a configured path for all subsequent I/O. If that path fails, I/O to the pseudo device fails. |



Table 5-2 indicates when native and pseudo devices are supported, and which device naming conventions we prefer in environments with specified software requirements. If no preference is specified, both supported options are equally good.

**Table 5-2 Support for Native and Pseudo Devices**

| Software Requirements                                                                                                                                                                                       | Are Native Devices Supported? | Are Pseudo Devices Supported? |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------|
| <b>Boot Requirements</b>                                                                                                                                                                                    |                               |                               |
| Boot-time failover—Symmetrix and CLARiiON                                                                                                                                                                   | No                            | ✓ (For the root filesystem)   |
| <b>Volume Managers</b>                                                                                                                                                                                      |                               |                               |
| VxVM 3.1.1 and later <ul style="list-style-type: none"> <li>New installations of PowerPath (DMP always is fully configured and enabled)</li> <li>Existing installations of PowerPath</li> </ul>             | ✓ (Preferred)<br>✓            | ✓<br>✓                        |
| VxVM 3.1 and earlier <ul style="list-style-type: none"> <li>New installations of PowerPath (DMP may be enabled or disabled)</li> <li>Existing installations of PowerPath</li> </ul>                         | ✓ (Preferred)<br>✓            | ✓<br>✓                        |
| Other volume managers (including Sun's DiskSuite, raw devices, filesystems on raw devices, and raw table spaces) <ul style="list-style-type: none"> <li>If DR is used</li> <li>If DR is not used</li> </ul> | ✓<br>✓                        | ✓ (Preferred)<br>✓            |

## Reconfiguring PowerPath Devices Online

Whenever the physical configuration of the storage system or the host changes, you must reconfigure the PowerPath devices to avoid data loss.

Configuration changes that require you to reconfigure PowerPath devices include:

- ◆ Adding or removing HBAs
- ◆ Adding, removing, or changing storage system logical devices
- ◆ Changing the cabling routes between HBAs and storage system ports
- ◆ Adding or removing storage system interfaces



### CAUTION

**If you are trying to recover from a SCSI bus ID conflict, you must reboot the host before completing the following procedure. The host reboot assures the integrity of the underlying SCSI driver layers so that PowerPath can find all devices on the bus.**

To reconfigure PowerPath devices:

1. Update the `/kernel/drv/sd.conf` file to include target/logical device entries for all multipath storage system logical devices.
2. Create the device nodes. Enter the appropriate command:

| On hosts running    | Enter                                 |
|---------------------|---------------------------------------|
| Solaris 7, 8, and 9 | <code>devfsadm -C</code>              |
| Solaris 2.6         | <code>drvconfig;disks;devlinks</code> |

3. Use the `format` command to verify that all devices were created.
4. At the format prompt, enter `inquiry`.

The screen displays the emcpower device's inquiry data; for example:

```
Vendor: EMC
Product: SYMMETRIX
Revision: 5x6x
format>
```

5. Enter **quit**, to end the format process.
6. Create the new device nodes. Enter:

```
powercrf -q
```

PowerPath displays the following message as it creates new devices:

```
Creating new device nodes
```

7. Verify that the emcpower devices are accessible. For example, enter:

```
format /dev/rdisk/emcpower1a
```

The screen displays the following information:

```
FORMAT MENU:
disk - select a disk
type - select (define) a disk type
partition - select (define) a partition table
current - describe the current disk
format - format and analyze the disk
repair - repair a defective sector
label - write label to the disk
analyze - surface analysis
defect - defect list management
backup - search for backup labels
verify - read and display labels
save - save new disk/partition definitions
inquiry - show vendor, product and revision
volname - set 8-character volume name
quit
format>
```

8. Display the new device. Enter:

```
powermt display dev=all
```

## Dynamic Reconfiguration

The Solaris Dynamic Reconfiguration (DR) feature allows you to add or remove an HBA from a Solaris system while the system continues running. You can logically attach and detach system boards from the operating system without halting and rebooting. For example, with DR you can detach a board from the operating system, physically remove and service the board, and then re-insert the board and re-attach it to the operating system—without halting the operating system or terminating any user application.

PowerPath supports DR. The following procedures describe how to use DR to add and remove HBAs in a PowerPath environment.

As you perform these procedures, have available the Sun Dynamic Reconfiguration documentation for your platform.

---

If you have a custom PowerPath configuration that you have not yet saved, run `powermt save` before completing the procedures in this section, to save your configuration changes. Run `powermt load` after completing these procedures, to restore your configuration.

---

---

### Adding an HBA to a PowerPath Configuration

To use DR to add an HBA to a Solaris system in a PowerPath configuration, follow these steps:

1. Add the new HBA to the system, following the instructions in the Sun Dynamic Reconfiguration documentation.
2. Configure the new HBA. Enter:

```
powermt config
```

## Removing an HBA From a PowerPath Configuration

To use DR to remove an HBA from a Solaris host in a PowerPath configuration, follow these steps:

1. Correlate the `c#t#d#s#` device special files of the HBA being removed with the PowerPath adapter number for that HBA. The PowerPath adapter number is used in the `powermt remove adapter` command later in this procedure.

On 10000 class systems:

- Start the `dr` shell. Enter:

```
dr
```

The prompt changes to `dr>`.

- From within the `dr` shell, list the devices and corresponding `c#t#d#s#` device special files on the I/O board being removed. For example, for I/O board 1, enter:

```
drshow 1
```

The command returns output like the following:

```
I/O Bus Controllers and Devices for Board 1
----- I/O Bus 1 : Slot 0 : esp0 -----

device opens name usage
----- -
sd838 4 /dev/dsk/c2t0d1s2 /test
...
```

`drshow` displays all device special files that point to HBAs on the I/O board. In the example above, board 1 Slot 0 has a single device (HBA) attached named `c2t0d1s2`.

- Press CTRL-D to exit the `dr` shell.
- Associate the device special file (identified above with `drshow`) with a PowerPath adapter number. Enter:

```
powermt display dev=all
```

The command returns output like the following:

```
pseudo name=emcpower0a
Symmetrix ID=000000003269;
logical device ID=048
state=alive; policy=SymmOpt; priority=0; queued-I/Os=0
=====
----- Hosts ----- - Sys - - I/O Paths - --- Stats --
HW Path I/O Path Interf. Mode State Q-I/Os Errors
=====
0 psbus@b/QLGC,isp@0 c2t0d1 SA 16aB active alive 0 0
```

In the output, locate device c2t0d1. Notice that the adapter number for c2t0d1 is 0; therefore, 0 is the adapter number you use as an argument to `powermt remove hba` in step 2.

2. Use `powermt remove adapter` to remove the HBA from the PowerPath configuration. Enter:

```
powermt remove hba=#
```

where # corresponds to the PowerPath adapter number identified in step 1.

3. Disconnect the HBA, following the instructions in the Sun Dynamic Reconfiguration documentation.

---

## Upgrading Solaris

PowerPath 4.0 supports Solaris Live Upgrade, which lets you upgrade the operating system without uninstalling PowerPath.

---

Solaris Live Upgrade is supported for upgrades to Solaris 9 only. If you are upgrading to an earlier version of Solaris, you must uninstall PowerPath before you upgrade the OS and then reinstall PowerPath after the upgrade.

---

### Upgrading to Solaris 9 with Solaris Live Upgrade

The PowerPath 4.0 package includes a script, `sol9_liveup.sh`, located in the `scripts` subdirectory of the PowerPath 4.0 installation directory (for example, `/opt/EMCpower/scripts`). You must run this script before you activate Solaris 9.

---

Solaris Live Upgrade does not work when booting off emcpower devices.

To upgrade to Solaris 9:

1. Ensure that the HBA driver is supported with Solaris 9. Otherwise, Solaris Live Upgrade will not work.
2. Install PowerPath 4.0 on the host.
3. Optionally, save the `sd.conf` file.

Solaris Live Upgrade may replace `sd.conf` with a default `sd.conf` file, causing devices to become inaccessible. If those devices are system critical devices, the new boot image will not work.

Solaris Live Upgrade saves a copy of the `sd.conf` file in `/kernel/drv/sd.conf.~version` (where `version` is the Solaris version from which you are upgrading; for example, if you are upgrading from Solaris 8, the file name is `sd.conf.~8`.) Nevertheless, you might want to save `sd.conf` before you start the upgrade.

4. Install Solaris Live Upgrade on the host.
5. Create an inactive boot environment. Follow the instructions in the *Solaris 9 Installation Guide*.
6. Upgrade the inactive boot environment. Follow the instructions in the *Solaris 9 Installation Guide*.

7. Run the `sol9_liveup.sh` script and then activate the inactive boot environment:
  - a. Mount the root of the inactive boot environment to a directory such as `/mnt`.
  - b. Run the script `sol9_liveup.sh`. Enter:

```
cd /install_dir/EMCpower/scripts
./sol9_liveup.sh /mnt
```

where *install\_dir* is the base install location of the EMCpower package. For example, if the base install directory is `opt`, enter:

```
cd /opt/EMCpower/scripts
./sol9_liveup.sh /mnt
```
  - c. Continue with the procedure documented in the *Solaris 9 Installation Guide*.

### Troubleshooting

If Solaris Live Upgrade replaces the `sd.conf` file with a default `sd.conf`, the new boot image may not work. In this case, replace the default `sd.conf` with either the file Solaris Live Upgrade automatically saved in `/kernel/drv/sd.conf.~version` or the file you saved before starting the upgrade procedure. (See step 3, above.)

If you fail to run `sol9_liveup.sh` before activating Solaris 9, the new boot image will not work. In this case:

1. Boot from the older Solaris boot area.
2. Mount the Solaris 9 boot area.
3. Run `sol9_liveup.sh` in the Solaris 9 boot area.
4. Boot Solaris 9.



---

## powercf Configuration Utility

During system boot on Solaris hosts, the `powercf` utility configures PowerPath devices by scanning HBAs for both single-ported and multiported storage system logical devices. (A multiported logical device shows up on two or more HBAs with the same storage system subsystem/device identity. The identity comes from the serial number for the logical device.) For each storage system logical device found in the scan of the HBAs, `powercf` creates a corresponding `emcpower` device entry in the `emcp.conf` file, and it saves a primary path and an alternate primary path to that device.

After PowerPath is installed, you need to run `powercf` only when the physical configuration of the storage system or the host changes. Configuration changes that require you to reconfigure PowerPath devices include the following:

- ◆ Adding or removing HBAs
- ◆ Adding, removing, or changing storage system logical devices
- ◆ Changing the cabling routes between HBAs and storage system ports
- ◆ Adding or removing storage system interfaces

Refer to *Reconfiguring PowerPath Devices Online* on page 5-10 for instructions on reconfiguring PowerPath devices on Solaris.

---

### File Location

The `powercf` utility resides in the `/etc` directory.

---

### Executing `powercf`

You must have superuser privileges to use `powercf`.

To run `powercf` on a Solaris host, type the command, plus any options, at the shell prompt.

---

### `emcp.conf` File

The `/kernel/drv/emcp.conf` file lists the primary and alternate path to each storage system logical device and the storage system device serial number for that logical device. The `powercf -q` command updates the existing `emcp.conf` file or creates a new one if it does not already exist.

---

### Syntax

```
powercf -q|-z
```

---

## Arguments

`powercf` scans HBAs for single-ported and multiported storage system logical devices and compares those logical devices with PowerPath device entries in `emcp.conf`.

`-q`

Runs `powercf` in quiet mode.

`powercf -q` updates the `emcp.conf` file by removing PowerPath devices not found in the HBA scan and adding new PowerPath devices that were found. It saves a primary and an alternate path to each PowerPath device.

`powercf -q` runs automatically during system boot.

`-Z`

Configures an SRDF-enabled server to be bootable from an R2 mirror of a Symmetrix-based `emcpower` boot disk by a remote host.

`powercf -Z` should be run manually whenever such a server's Symmetrix volume configuration changes due to the addition or deletion of volumes.

---

## Error Messages

PowerPath reports any errors, diagnostic messages, and failover recovery messages to the system console and to the file `/var/adm/messages`. Refer to the *PowerPath Product Guide* for a complete list of PowerPath error messages.

## Files Changed By PowerPath

This appendix lists files that are created or modified by PowerPath installation and upgrade.

- ◆ Files Created or Modified by PowerPath Installation .....A-2
- ◆ Files Created or Modified by VCS Agent Installation ..... A-11

## Files Created or Modified by PowerPath Installation

The following files are created (or, where indicated, modified) when PowerPath is installed on a Solaris host:

---

### /etc

This directory contains PowerPath CLI commands and utilities:

- ◆ S87powervxvm
- ◆ cgmt
- ◆ emc/bin/emcp\_discover <symbolic link>
- ◆ emc/bin/emcp\_purge <symbolic link>
- ◆ emc/bin/inquiry.pp
- ◆ emcpcvt <symbolic link>
- ◆ emcpmgr
- ◆ emcpreg
- ◆ emcpupgrade
- ◆ emcpvcleanup
- ◆ powercf
- ◆ powermt
- ◆ powerprotect
- ◆ powervsvs
- ◆ powervshm
- ◆ powervxvm
- ◆ powermt.custom
- ◆ emcp\_registration
- ◆ emcp\_devicesDB.dat
- ◆ emcp\_devicesDB.idx
- ◆ emcpower\_mode-dir
- ◆ emcpv\_cleanup
- ◆ PPVM\_config
- ◆ PPVM\_config\_bak
- ◆ rc2.d/S02configcgs
- ◆ rcS.d/S24powerstartup
- ◆ rcS.d/S63powershift

---

## ***/basedir/EMCpower/bin***

This directory contains 32- and 64-bit versions of the PowerPath Volume Manager CLI commands:

- ◆ 64 <symbolic link>
- ◆ emcpminor <symbolic link>
- ◆ emcpminor\_32
- ◆ powervadm <symbolic link>
- ◆ powervadm\_32
- ◆ powervg <symbolic link>
- ◆ powervg\_32
- ◆ powervmeta <symbolic link>
- ◆ powervmeta\_32
- ◆ powervol <symbolic link>
- ◆ powervol\_32
- ◆ powervperf <symbolic link>
- ◆ powervperf\_32
- ◆ sparcv9/emcpminor <symbolic link>
- ◆ sparcv9/emcpminor\_64
- ◆ sparcv9/powervadm <symbolic link>
- ◆ sparcv9/powervadm\_64
- ◆ sparcv9/powervg <symbolic link>
- ◆ sparcv9/powervg\_64
- ◆ sparcv9/powervmeta <symbolic link>
- ◆ sparcv9/powervmeta\_64
- ◆ sparcv9/powervol <symbolic link>
- ◆ sparcv9/powervol\_64
- ◆ sparcv9/powervperf <symbolic link>
- ◆ sparcv9/powervperf\_64

---

## ***/basedir/EMCpower/driver***

This directory contains 32- and 64-bit versions of the PowerPath kernel files:

- ◆ 64 <symbolic link>
- ◆ emcp <symbolic link>
- ◆ emcp\_32
- ◆ emcp\_32\_5\_9
- ◆ emcp\_5\_9 <symbolic link>
- ◆ emcpcg <symbolic link>
- ◆ emcpcg\_32
- ◆ emcpcg\_32\_5\_9

- ◆ emcpcg\_5\_9 <symbolic link>
- ◆ emcpdpm <symbolic link>
- ◆ emcpdpm\_32
- ◆ emcpdpm\_32\_5\_9
- ◆ emcpdpm\_5\_9 <symbolic link>
- ◆ emcpevm <symbolic link>
- ◆ emcpevm\_32
- ◆ emcpevm\_32\_5\_9
- ◆ emcpevm\_5\_9 <symbolic link>
- ◆ emcphr <symbolic link>
- ◆ emcphr\_32
- ◆ emcphr\_32\_5\_9
- ◆ emcphr\_5\_9 <symbolic link>
- ◆ emcpioc <symbolic link>
- ◆ emcpioc\_32
- ◆ emcpioc\_32\_5\_9
- ◆ emcpioc\_5\_9 <symbolic link>
- ◆ emcpmp <symbolic link>
- ◆ emcpmp\_32
- ◆ emcpmp\_32\_5\_9
- ◆ emcpmp\_5\_9 <symbolic link>
- ◆ emcpmpc <symbolic link>
- ◆ emcpmpc\_32
- ◆ emcpmpc\_32\_5\_9
- ◆ emcpmpc\_5\_9 <symbolic link>
- ◆ emcpsapi <symbolic link>
- ◆ emcpsapi\_32
- ◆ emcpsapi\_32\_5\_9
- ◆ emcpsapi\_5\_9 <symbolic link>
- ◆ emcpsc <symbolic link>
- ◆ emcpsc\_32
- ◆ emcpsc\_32\_5\_9
- ◆ emcpsc\_5\_9 <symbolic link>
- ◆ emcpsm <symbolic link>
- ◆ emcpsm\_32
- ◆ emcpsm\_32\_5\_9
- ◆ emcpsm\_5\_9 <symbolic link>
- ◆ emcpte <symbolic link>
- ◆ emcpte\_32
- ◆ emcpte\_32\_5\_9
- ◆ emcpte\_5\_9 <symbolic link>
- ◆ sparcv9/emcp <symbolic link>
- ◆ sparcv9/emcp\_5\_9 <symbolic link>
- ◆ sparcv9/emcp\_64
- ◆ sparcv9/emcp\_64\_5\_9
- ◆ sparcv9/emcpcg <symbolic link>
- ◆ sparcv9/emcpcg\_5\_9 <symbolic link>

- ◆ sparcv9/emcpcg\_64
- ◆ sparcv9/emcpcg\_64\_5\_9
- ◆ sparcv9/emcpdpm <symbolic link>
- ◆ sparcv9/emcpdpm\_5\_9 <symbolic link>
- ◆ sparcv9/emcpdpm\_64
- ◆ sparcv9/emcpdpm\_64\_5\_9
- ◆ sparcv9/emcpevm <symbolic link>
- ◆ sparcv9/emcpevm\_5\_9 <symbolic link>
- ◆ sparcv9/emcpevm\_64
- ◆ sparcv9/emcpevm\_64\_5\_9
- ◆ sparcv9/emcphr <symbolic link>
- ◆ sparcv9/emcphr\_5\_9 <symbolic link>
- ◆ sparcv9/emcphr\_64
- ◆ sparcv9/emcphr\_64\_5\_9
- ◆ sparcv9/emcpioc <symbolic link>
- ◆ sparcv9/emcpioc\_5\_9 <symbolic link>
- ◆ sparcv9/emcpioc\_64
- ◆ sparcv9/emcpioc\_64\_5\_9
- ◆ sparcv9/emcpmp <symbolic link>
- ◆ sparcv9/emcpmp\_5\_9 <symbolic link>
- ◆ sparcv9/emcpmp\_64
- ◆ sparcv9/emcpmp\_64\_5\_9
- ◆ sparcv9/emcpmpc <symbolic link>
- ◆ sparcv9/emcpmpc\_5\_9 <symbolic link>
- ◆ sparcv9/emcpmpc\_64
- ◆ sparcv9/emcpmpc\_64\_5\_9
- ◆ sparcv9/emcpsapi <symbolic link>
- ◆ sparcv9/emcpsapi\_5\_9 <symbolic link>
- ◆ sparcv9/emcpsapi\_64
- ◆ sparcv9/emcpsapi\_64\_5\_9
- ◆ sparcv9/emcpsc <symbolic link>
- ◆ sparcv9/emcpsc\_5\_9 <symbolic link>
- ◆ sparcv9/emcpsc\_64
- ◆ sparcv9/emcpsc\_64\_5\_9
- ◆ sparcv9/emcpsm <symbolic link>
- ◆ sparcv9/emcpsm\_5\_9 <symbolic link>
- ◆ sparcv9/emcpsm\_64
- ◆ sparcv9/emcpsm\_64\_5\_9
- ◆ sparcv9/emcpte <symbolic link>
- ◆ sparcv9/emcpte\_5\_9 <symbolic link>
- ◆ sparcv9/emcpte\_64
- ◆ sparcv9/emcpte\_64\_5\_9

---

## /kernel/drv

This directory contains the PowerPath configuration file `emcp.conf`.

---

***/basedir/EMCpower/lib***

This directory contains 32- and 64-bit versions of the PowerPath libraries:

- ◆ 64 <symbolic link>
- ◆ libdpmh.so <symbolic link>
- ◆ libdpmh\_32.so
- ◆ libdpmhmt.so <symbolic link>
- ◆ libdpmhmt\_32.so
- ◆ libdpmu.so <symbolic link>
- ◆ libdpmu\_32.so
- ◆ libdpmumt.so <symbolic link>
- ◆ libdpmumt\_32.so
- ◆ libemcp.so <symbolic link>
- ◆ libemcp\_32.so
- ◆ libemcp\_lic\_rtl.so <symbolic link>
- ◆ libemcp\_lic\_rtl\_32.so
- ◆ libemcp\_mp\_rtl.so <symbolic link>
- ◆ libemcp\_mp\_rtl\_32.so
- ◆ libemcpcg.so <symbolic link>
- ◆ libemcpcg\_32.so
- ◆ libemcpmp.so <symbolic link>
- ◆ libemcpmp\_32.so
- ◆ libemcpmt.so <symbolic link>
- ◆ libemcpmt\_32.so
- ◆ libemcpvapi.so <symbolic link>
- ◆ libemcpvapi\_32.so
- ◆ libemcpvapimt.so <symbolic link>
- ◆ libemcpvapimt\_32.so
- ◆ libevm.so <symbolic link>
- ◆ libevm\_32.so
- ◆ libevmnt.so <symbolic link>
- ◆ libevmnt\_32.so
- ◆ libgm.so <symbolic link>
- ◆ libgm\_32.so
- ◆ libgmmt.so <symbolic link>
- ◆ libgmmt\_32.so
- ◆ libmp\_32.so <symbolic link>
- ◆ libom.so <symbolic link>
- ◆ libom\_32.so
- ◆ libommt.so <symbolic link>
- ◆ libommt\_32.so



- ◆ libpn.so <symbolic link>
- ◆ libpn\_32.so
- ◆ libradcommon.so <symbolic link>
- ◆ libradcommon\_32.so
- ◆ libradcommonmt.so <symbolic link>
- ◆ libradcommonmt\_32.so
- ◆ libraddebug.so <symbolic link>
- ◆ libraddebug\_32.so
- ◆ libraddebugmt.so <symbolic link>
- ◆ libraddebugmt\_32.so
- ◆ libsc.so <symbolic link>
- ◆ libsc\_32.so
- ◆ libscmt.so <symbolic link>
- ◆ libscmt\_32.so
- ◆ libsm.so <symbolic link>
- ◆ libsm\_32.so
- ◆ libsmmt.so <symbolic link>
- ◆ libsmmt\_32.so
- ◆ sparcv9/libdpmh.so <symbolic link>
- ◆ sparcv9/libdpmh\_64.so
- ◆ sparcv9/libdpmhmt.so <symbolic link>
- ◆ sparcv9/libdpmhmt\_64.so
- ◆ sparcv9/libdpmu.so <symbolic link>
- ◆ sparcv9/libdpmu\_64.so
- ◆ sparcv9/libdpmumt.so <symbolic link>
- ◆ sparcv9/libdpmumt\_64.so
- ◆ sparcv9/libemcp.so <symbolic link>
- ◆ sparcv9/libemcp\_64.so
- ◆ sparcv9/libemcp\_lic\_rtl.so <symbolic link>
- ◆ sparcv9/libemcp\_lic\_rtl\_64.so
- ◆ sparcv9/libemcp\_mp\_rtl.so <symbolic link>
- ◆ sparcv9/libemcp\_mp\_rtl\_64.so
- ◆ sparcv9/libemcpcg.so <symbolic link>
- ◆ sparcv9/libemcpcg\_64.so
- ◆ sparcv9/libemcpmp.so <symbolic link>
- ◆ sparcv9/libemcpmp\_64.so
- ◆ sparcv9/libemcpmt.so <symbolic link>
- ◆ sparcv9/libemcpmt\_64.so
- ◆ sparcv9/libemcpvapi.so <symbolic link>
- ◆ sparcv9/libemcpvapi\_64.so
- ◆ sparcv9/libemcpvapimt.so <symbolic link>
- ◆ sparcv9/libemcpvapimt\_64.so
- ◆ sparcv9/libevm.so <symbolic link>

- ◆ sparcv9/libevm\_64.so
- ◆ sparcv9/libevmmt.so <symbolic link>
- ◆ sparcv9/libevmmt\_64.so
- ◆ sparcv9/libgm.so <symbolic link>
- ◆ sparcv9/libgm\_64.so
- ◆ sparcv9/libgmmt.so <symbolic link>
- ◆ sparcv9/libgmmt\_64.so
- ◆ sparcv9/libmp\_64.so <symbolic link>
- ◆ sparcv9/libom.so <symbolic link>
- ◆ sparcv9/libom\_64.so
- ◆ sparcv9/libommt.so <symbolic link>
- ◆ sparcv9/libommt\_64.so
- ◆ sparcv9/libpn.so <symbolic link>
- ◆ sparcv9/libpn\_64.so
- ◆ sparcv9/libradcommon.so <symbolic link>
- ◆ sparcv9/libradcommon\_64.so
- ◆ sparcv9/libradcommonmt.so <symbolic link>
- ◆ sparcv9/libradcommonmt\_64.so
- ◆ sparcv9/libraddebug.so <symbolic link>
- ◆ sparcv9/libraddebug\_64.so
- ◆ sparcv9/libraddebugmt.so <symbolic link>
- ◆ sparcv9/libraddebugmt\_64.so
- ◆ sparcv9/libsc.so <symbolic link>
- ◆ sparcv9/libsc\_64.so
- ◆ sparcv9/libscmt.so <symbolic link>
- ◆ sparcv9/libscmt\_64.so
- ◆ sparcv9/libsm.so <symbolic link>
- ◆ sparcv9/libsm\_64.so
- ◆ sparcv9/libsmmt.so <symbolic link>
- ◆ sparcv9/libsmmt\_64.so

---

## ***/basedir/EMCpower/man/man1***

This directory contains the PowerPath Volume Manager man pages:

- ◆ powervadm.1
- ◆ powervg.1
- ◆ powervintro.1
- ◆ powervmeta.1
- ◆ powervol.1
- ◆ powervperf.1

---

## ***/basedir/EMCpower/scripts***

This directory contains PowerPath scripts:

- ◆ emcpv\_cleanup
- ◆ emcpv\_cron\_remove.sh
- ◆ emcpv\_cron\_setup.sh
- ◆ emcpv\_logchecker
- ◆ emcpv\_setup.csh
- ◆ emcpv\_setup.sh
- ◆ emcpv\_slv2devinfo
- ◆ sol9\_liveup.sh

---

## ***/usr/bin***

This directory contains `powervini`, the PowerPath Volume Manager initialization file.

---

## ***/usr/man/man1***

This directory contains the PowerPath man pages:

- ◆ emcp\_discover.1 <symbolic link>
- ◆ emcp\_purge.1 <symbolic link>
- ◆ emcpminor.1
- ◆ emcpreg.1
- ◆ emcpupgrade.1
- ◆ powercf.1
- ◆ powermt.1

## Solaris Files Modified by PowerPath Installation

Installing PowerPath on a Solaris host modifies the:

- ◆ `/etc/system` configuration file:
  - Adds `forceload` statements for the PowerPath driver and miscellaneous kernel modules.
  - Adds `set` statements for kernel `stksize` variables to increase default kernel stack sizes and avoid stack overflow panics.
- ◆ `/etc/.login` and `/etc/profile` scripts so that it runs the PowerPath setup script at system boot.

- The installation program adds the following line to the `/etc/.login` script:

```
source /base_directory/EMCpower/scripts/emcpv_setup.csh
```

- The installation programs add the following line to the `/etc/profile` script:

```
. /base_directory/EMCpower/scripts/emcpv_setup.sh
```

---

## Files Created or Modified by VCS Agent Installation

The following files are created when the PowerPath Volume Manager VCS Agent is installed on a Solaris host.

---

### ***/basedir/VRTSvcs/EMC***

- ◆ bin/EMCvgAgent
- ◆ lib/libEMCvg.so
- ◆ messages.EMC
- ◆ scripts/\_abortOnline
- ◆ scripts/\_getResAttr
- ◆ scripts/\_getResAttrLocal
- ◆ scripts/\_getTypeAttr
- ◆ scripts/\_isResExist
- ◆ scripts/\_setChldResAttr
- ◆ scripts/\_setResAttr
- ◆ scripts/\_setTypeAttr
- ◆ types/EMCVgTypes.cf

---

### ***/basedir/VRTSvcs/bin/EMCvg***

- ◆ EMCvgAgent (symbolic link to  
*/base\_directory/VRTSvcs/EMC/bin/EMCvgAgent*)

---

### ***/etc/VRTSvcs/conf/config***

- ◆ EMCTypes.cf

---

### ***/usr/lib***

- ◆ libEMCvg.so (symbolic link to  
*/base\_directory/VRTSvcs/EMC/lib/libEMCvg.so*)



---

This appendix reviews the EMC process for detecting and resolving software problems, and provides essential questions that you should answer before contacting the EMC Customer Support Center.

This appendix covers the following topics:

- ◆ Overview of Detecting and Resolving Problems ..... B-2
- ◆ Troubleshooting the Problem ..... B-3
- ◆ Before Calling the Customer Support Center ..... B-4
- ◆ Documenting the Problem..... B-5
- ◆ Reporting a New Problem ..... B-6
- ◆ Sending Problem Documentation..... B-7

## Overview of Detecting and Resolving Problems

EMC software products are supported directly by the EMC Customer Support Center in the United States.

EMC uses the following process to resolve customer problems with its software products (Figure B-1).

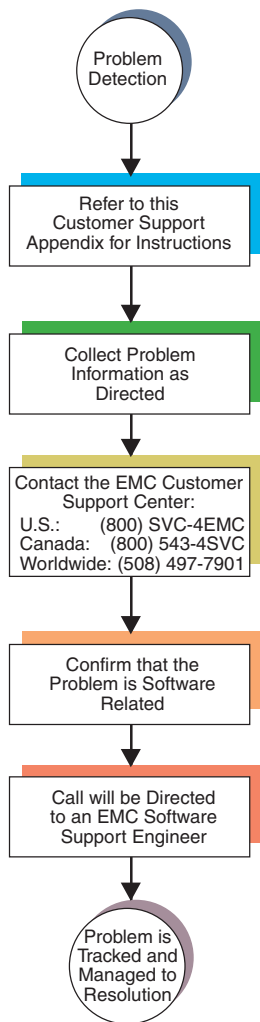


Figure B-1 Problem Detection and Resolution Process



## Troubleshooting the Problem

Please perform the relevant diagnostic steps before you contact the EMC Customer Support Center:

1. Read the documentation carefully.
2. Reconstruct the events leading up to the problem and describe them in writing.
3. Run some test cases to reproduce the problem.

If you encounter a problem that requires technical programming or analysis, call the nearest EMC office or contact the EMC Customer Support Center at one of the following numbers:

United States: **(800) 782-4362 (SVC-4EMC)**

Canada: **(800) 543-4782 (543-4SVC)**

Worldwide: **(508) 497-7901**

---

Please do not request a specific support representative unless one has already been assigned to your particular system problem.

---

For additional information on EMC products and services available to customers and partners, refer to the EMC Powerlink website at:

<http://powerlink.EMC.com>

## Before Calling the Customer Support Center

Have the following information available before calling the Customer Support Center or your support representative (if one has been assigned to you):

- Your company name
- Your name
- Your phone number
- For an existing problem, the problem tracking system ID, if one was previously assigned to the problem by a support representative

## Documenting the Problem

If the EMC Customer Support Center requests information regarding the problem, please document it completely, making sure to include the following information:

- Your company name and address
- Your name
- Your telephone number
- The importance of the problem, so that it can be assigned a priority level

To expedite the processing of your support request, you can photocopy this list and include it with the package.

## Reporting a New Problem

For a new problem, please provide the following information:

- Release level of the software that you are running
- Software installation parameters
- Host type on which you are running
- Operating system you are running and its release number
- Functions of the software that you are running
- Whether you can reproduce the problem
- Previous occurrences of the problem
- Whether the software has ever worked correctly
- Time period that the software did work properly
- Conditions under which the software worked properly
- Changes to your system between the time the software worked properly and the problem began
- Exact sequence of events that led to the system error
- Message numbers and complete text of any messages that the system produced
- Log file dated near the time the error occurred
- Results from tests that you have run
- Other related system output
- Other information that may help solve the problem

---

## Sending Problem Documentation

Use one of the following methods to send documentation of the problem to the EMC Customer Support Center:

- ◆ E-mail
- ◆ FTP
- ◆ U.S. mail to the following address:

EMC Customer Support Center  
45 South Street  
Hopkinton, MA 01748-9103

If the problem was assigned a number or a specific support representative, please include that information in the address as well.



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